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Frederick Rand Rogers

"Whatever your goal may be, strike out for it! What if you die in the attempt? Well, if you put every shred of yourself into the attempt, you will have had life's one great exhilarating and soul-satisfying experience anyhow. And when you start out to pursue your dreams, be prepared for a great discovery. It is the effort itself that will give you peace. This peace goes with you as you grow older, becomes your choicest companion, never leaves you. Wresting this peace from a troubled world is about all there is to the secret of happiness."

—Ralph Waldo Emerson

The American Physical Education Association

March, 1935, Supplement to *The Research Quarterly*

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PREFACE

In general, measurement in physical education is rapidly leaving a lusty infancy to become almost youthful, but on the same scale tests of muscular power are full-grown. Since these are involved in most of the studies of this symposium, a special note is in order here concerning them. Beginning in the dark ages with "feel my muscle!" as significant tests of physical power, strength tests have passed through many stages, including particularly that brief era inspired by Dudley Allen Sargent —for whom they should be named, if any name deserves that distinction. . . . The present writer was first introduced to the "Harvard Strength Tests" in 1911, and began experimenting with them in 1920. His Ph.D. dissertation, standardizing, validating, norming, and proposing educational uses for strength tests, was completed in 1925, but it was not until 1927 that New York State schools began redirecting their programs in accordance with physical fitness test results. In 1934, the writer summarized in *Recent Strength-Testing Literature* some 25 studies printed between 1925 and 1934; and lo! already another score are offered to a cautious but sanguine profession. Strength-testing techniques and dependent educational procedures are no longer in their swaddling clothes!

* * * *

Readers will note wide variations in the style, content, and thoroughness of the studies included in this symposium. This is to be desired rather than otherwise. It makes for readableness, interest, the exorcism of a tedious scholasticism. But let hasty critics be forewarned: the conclusions from even the most cursory report may be modified, but they are not likely to be reversed by more thorough research. For there is a buttressing, a reinforcing, of each study by so many others that the bundle has almost become a rod.

* * * *

The authors and editor are indebted to the American Physical Education Association, to President Daniel L. Marsh of Boston University, to Dean Arthur H. Wilde of the School of Education of Boston University, and to a few selected advertisers for the privilege of, and encouragement and support in, presenting the studies of this Supplement to a progressive group of physical educators. May their earthly joys be multiplied, and their satisfaction in our efforts equal our gratitude for their assistance.

* * * *

Just half of the studies included in this symposium originated in Boston. It has been our desire to bring together the most pertinent and practically useful documents available, no matter what their source. We regret only that lack of time and space prevented us from adding others to the list.

* * * *

Must we explain the enthusiasm of our authors? Must they answer again to the gentle reproach, "The lady doth protest too much?"

But if their cause is worthy and their conclusions sound—***why not?***

Boston, February 16, 1935

F. R. R.

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PRELUDE

SYMPATHETIC readers of this symposium may, if they attend closely, hear strains as of music in its essays and reports. For these studies outline philosophies or explain theories or report experiments whose purposes are to promote health and happiness, social character and joy, culture and appreciations of the world-around. Indeed, the editor might as well confess at once that this particular offspring of the printing press—which disgorges ugly ducklings and swans with equal disdain for their intrinsic worth or the favor of multitudes—was conceived and organized in the spirit and form of an educational symphony.

An "unfinished" symphony, perhaps, though bearing no resemblance to Schubert's great work. Unfinished because so many of its studies barely suggest themes which cry out to be completed; because too few experimental cases are involved to give authority to conclusions; and because of repetitions which that inexorable tyrant Time prevented us from eradicating from the score. But educational music still, in form and content; harmonies and melodies repeated again and again but always with illuminating variations and comprehensive codas; disharmonies here and there as improper educational practices or measuring devices are exposed or criticized; climaxes in all-convincing research reports following the announcement of themes by less ambitious but even more revealing studies—because in their simplicity we hear the motif even more clearly.

* * * *

Part I of our modest educational symphony—the "first movement" —announces at once the main theme: we are concerned chiefly with measurements in physical education, measurements of immediate and real value, measurements which relate to and assist in achieving educational objectives—measurement creation, improvement, criticism, and use. This movement is, as it should be, varied in tempo and subject; incomplete; confusing in parts; needing to be read over again and again to be understood; needing imagination properly to fill in the obvious gaps; but always the subject of measurement is evident. *Allegro ma non troppo* is the tempo.

Part II reports almost exclusively experiments in the improvement of physical fitness: *power, vitality!*—that quality of character from which all else flows. It is withal a restrained movement, full of harmony, rhythm, song. The theme is simple, infinitely repeated but growing in complexity through the long list of studies. There are two minor themes and climaxes: one for the guidance of children through school months; the other for their vacation months. Philosophers will read it *allegretto*, with smiling compassion, as Conrad says, for that great weakness which must be recognized with infinite compassion as the common inheritance

of us all. Perhaps some of them will hear cadences and strains of the second movement of César Franck's *Symphony in D Minor*. . . .

Part III is exciting, provocative, threatening, promising, challenging! "Why have you delayed so long to put your common philosophy to the test?" it demands. The first rule of good sportsmanship is fair play, equality between opponents. Shall we acknowledge it in deed as well as word? For it "works!" It can be made to function in practice! "Dare to be a Daniel!" it shouts; and promises joy to players and victory without exception to education's saints who live according to their words. Read it *allegro molto vivace*, and recall the third movement of Tschaikowsky's poignant *Sixth*.

Part IV is an unsatisfying closing movement, because so much remains to be said. Studies of pupil-freedom-with-responsibility ("player-control"), cultural development, the application of physical education measurements to industry and recreation, are still missing. So, also perhaps, are those finally-convincing studies which would confound the scoffers, melt the cynics, challenge the active interest of the indifferent; and win the unquestioned support of the open-minded, the active loyalty of well-wishers, and the undying fidelity of friends. We would that these studies were available now, so we might spread them before the reader with hosannas, in the spirit "what hath God wrought!" and claim artistic affinity with the tempo and triumphant glory of the final movement of Brahms' *C Minor* or Beethoven's immortal *Fifth*.

But the included studies are promises of such a future, in which physical educators' measurements, investigations, and philosophy will encompass human experience, needs, and hopes. Part IV closes with a rapid finale: a brief glimpse of the personalities and contributions of the authors, who have so generously favored the Association with their studies and so graciously honored the University by their participation in a truly amateur venture.

Part I

Measurements: Tools and Criticisms

"The problem of physical education is susceptible of precision. It should be attacked by every means that modern science has at its disposal. Whenever one takes pains to measure, ideas become clearer; to introduce a new instrument of measurement is to render a greater service to the cause than to form opinions or prejudices." —G. Demeny.

Tests and Measurements in Physical Education*

By W. W. H. Mustaine

FIRST PRINCIPLES

IN THE field of physical education the comparatively recent work of Bovard, Cozens, Kleeberger, McCloy, McCurdy, Neilson, Rogers, Schneider, Wayman, and others attest to the present activity in test and measurement research. Physical education tests began with tests of strength and of abilities in the fundamental large-muscle activities such as running, jumping, climbing, throwing, and others—all of which are fundamental curricular materials in physical education and all of which have some practical value.

Inasmuch as practically all of the elementary, and most of the secondary, school programs are designed for general education rather than to prepare specifically for vocations, tests and measurements of achievement in curricular materials, simple or complex, are justifiable only to the extent that such achievement is significant in respect to the general educational outcomes for which elementary and secondary school programs are instituted.

It is obviously a useless procedure to conduct tests which contribute little or nothing toward desired goals. Many such tests have been proposed for use in mental as well as in physical education. Their relation to objectives is of a most tenuous character, and they even are preserved in our current literature long after they have been proved relatively unreliable and invalid. Measurement in physical education will have passed adolescence when tests are properly validated, and normed, and their all-round economy and utility demonstrated before being presented for general use.

Remember also, to use tests *as an aid* but not to rely on them exclusively or implicitly. It is a matter of common observation that pupils may excel in the school curriculum and yet fail to achieve the true objectives of education. Thus it is seen that in selecting tests in physical education we must first decide upon our educational objectives. We should then consider what tests and measurements may best promote their achievement.

Since class organization is one of the first things to be done by the administrator or teacher, tests which are fundamental to the proper grouping of pupils should be given first place. The tests used as a basis of class organization should be recognized and proved in practice to be sound and should have true educational significance. Inasmuch as cur-

* This résumé was adapted from an article of the same name in *The Cadat* of Phi Delta Pi, April, 1932.

ricular materials must be adjusted to the pupils, and not vice versa, it seems obvious that these initial tests should be for the purpose of determining pupil status and pupil needs.

It would seem to be a sensible approach to the problem of selection for each teacher or administrator to consider first just why he wants to give tests, what uses he expects to make of them, and whether such uses have sufficient educational or administrative value to justify the expenditure of the time and energy that the tests will require.

After answering these questions the teacher will be better prepared to select the tests that are needed. As a possible aid in solving the quandary, it is suggested here that tests and measurements in physical education are needed primarily (1) to determine the present status of individual pupils, on the basis of which (2) to classify pupils according to their capacities and needs, and that (3) in athletics, opposing teams may be equalized so that (4) we may better develop social attitudes—all so that (5) programs may be differentiated to meet individual pupil needs, and (6) appropriate standards in the field of greatest needs may be determined, whereby (7) a means of judging pupil progress toward educational objectives may be provided, and (8) the efficiency of teachers and the relative merits of different types of activity programs as well as the factors of time, equipment, and space, may be fairly and significantly evaluated, thus (9) winning greater respect and better support for our programs and ourselves, and (10) giving our records and reports more meaning.

THIS PHILOSOPHY AS APPLIED IN NEW YORK

With the considerations in mind which have been briefly outlined, it may be of interest to physical educators to learn how this testing philosophy has been applied in New York and, to some extent already, in Colorado, Minnesota, Massachusetts, California and a few other states. For convenience, and because of the writer's relation to the New York program, what follows will, with the reader's permission, be expressed in the "first person." This program has been in operation in a steadily increasing number of cities and villages of New York since 1927. It has definitely passed the experimental stage, and is incorporated as a vital and integral part of the new syllabi published in 1934 and 1935.

We in New York, in an effort to provide a logical basis upon which curricular materials, tests, methods, and all else connected with the State program may be rationally and defensibly determined, have accepted three general aims for our physical education programs. These are stated as ***health, social efficiency***, and ***culture***. They seem to constitute the least common denominators of practically all the objectives of education proposed by educational philosophers. The terms are comprehensive; they are descriptive of ultimate goals and hence provide quite nebulous concepts. They are greatly useful, however, in indicating general fields, and for the more practical guidance of teachers they have

been split up, in our new syllabus, into their component parts, which we call *specific objectives*. Only those specific objectives which are most attainable through physical education activities are considered in our syllabi; and these, we believe, are sufficiently definite to provide reference points for practical use, or guides to the selection of measurements and methods. With these definite goals in view, teachers may more readily measure the progress made by pupils toward the goals; and thus evaluate the methods, types of activities, administrative organization and policies, equipment, teaching efficiency, and other factors of educational machinery.

At the outset we determined upon what we believe to be the primary, though not necessarily the most important, educational aim of physical education, which is stated as *dynamic physiologic health*, or *physical fitness*, and may be defined briefly as "capacity for physical activity." We believe this should be our primary aim not only because it is a fundamental present and future need of all school children and because it is essential to all learning, but also because physical education activities so directly, so obviously, and so greatly affect physical fitness whether for good or ill. Our programs are therefore adjusted first in respect to their effects on general dynamic health, or fitness for physical activity.

Since the effects of physical activities themselves are indeterminate, depending on the needs, capacities, and interests of the individual child, pupils are first classified according to their general physical fitness, so that their programs may be properly differentiated and adjusted to their individual health needs. This screening process is accomplished by means of physical fitness tests and medical examinations. The medical examinations are given by school or family physicians, and the physical fitness tests are administered by physical educators.

A TEST OF PHYSICAL FITNESS

The test generally used in New York State is the now familiar P.F.I. battery. It is described and discussed quite thoroughly in a text [1] and its process of development and statistical defense are presented in detail in a doctor's dissertation.[2] Briefly, this test comprises the factors of age, height and weight, and a battery of seven dynamic tests including lung capacity and strength measurements of the muscles of the right and left forearms (grips), the muscles of upper arms and shoulder girdle (pull-ups and push-ups, with special adjustments made for girls), and back and leg muscles. The tests are simple; but accuracy and uniformity of testing technic, as in all careful testing, are important. As an aid to teachers in standardizing their testing technic and applying the resulting data educationally, A. S. Barnes and Company has issued a manual,[3] in

[1] *Fundamental Administrative Measures in Physical Education*, Frederick Rand Rogers, The Pleiades Company, Newton, Mass.

[2] *Physical Capacity Tests in the Administration of Physical Education*, Bureau of Publications, Teachers College, Columbia University.

[3] *Physical Capacity Tests:* Notes on Testing Technique and the Uses of the Scores.

which testing techniques are illustrated and explained in detail. This manual is based on five years' experience of directors in New York State, testing some hundreds of thousands of boys and girls in junior and senior high schools.

The scores made by each pupil in the separate items of the test are added and constitute the individual pupil's *Strength Index*. By dividing this achieved S.I. by the norm for the age and weight of the individual, a quotient called the *Physical Fitness Index* (P.F.I.) is calculated. The norm tables for boys and for girls are different and are adjusted to all combinations of age and weight.

These tests are given to junior and senior high school pupils, usually not over twice a year; and if properly organized by the physical director can be given to pupils at the approximate rate of one pupil per minute; that is, a group of forty pupils can be tested in forty to forty-five minutes, with the aid of one or two adult assistants and a few trained pupils.

HOW THE DATA ARE USED

Having tested all pupils, the teacher arranges their individual record cards in progressive order according to P.F.I.'s from the lowest to the highest. These usually range from about P.F.I. 45 to P.F.I. 160. A percentage, usually 15 to 25 per cent (depending on the available staff and facilities), of these record cards is then counted off, beginning with the lowest P.F.I., thus determining a division point, usually at about P.F.I. 85–90, and pupils whose scores are less than that are regarded as being "low in physical fitness." *Medical examinations are given prior to the tests and pupils found to be unfitted for the tests are placed automatically in the low group.* A search is then made for the probable causes of low physical fitness in each individual case, upon the basis of which suitable individual programs are determined, with the chief, though not exclusive, emphasis on the correction of physical abnormalities and health development. The programs of the high fitness group (pupils with P.F.I.'s of over 110 or 115) are similarly adjusted, with the chief emphasis on the development of cultural appreciations and of good social traits, such as cooperation, ability to meet responsibility, courage, honesty, perseverance, and others. Pupils in the middle group (between P.F.I. 85 and P.F.I. 110) are provided with the usual general program of activity with all objectives about equally emphasized.

A second important use of strength tests is in the equalization of the powers of opposing teams or individuals in sports. Strength tests have been found to be highly useful in accomplishing this adjustment, *whose end is the improvement of pupils' social efficiency.*

RESULTS

The results achieved by these programs of measurement and adaptation of activities to individual needs are difficult to summarize briefly.

1. Pupils increase markedly in physical powers (it has repeatedly been shown that, in traditional programs, the tendency is for pupils to decline steadily though slowly). Discipline becomes a minor problem. Pupils' social traits improve more rapidly than in the traditional programs. The organization of work makes it possible for the physically superior pupils to improve their "culture" more rapidly. Thus all educational aims are better served.

2. Parents derive much more satisfaction from the objective methods of determining their children's needs, from the obvious good results achieved and from the evidence given that teachers have reasonable aims and perform valuable services.

3. Principals and superintendents are likewise pleased and encouraged to provide better facilities and more equipment and time for physical education.

4. But perhaps the most significant gain is in the increased integrity of physical educators themselves, in their assurance that worth-while aims are being achieved in fact.

This rough outline can give only a general picture of the New York program, but it may serve to indicate our underlying philosophy and some of the ways in which this philosophy is being applied in the selection and use of tests, in curriculum construction and differentiation, and in the determination of administrative policies. The P.F.I. tests have proved to be very significant as a measure of general physical condition, or physical fitness; and, though it is inevitable that errors are made occasionally in using scores for pupil classification in unusual cases, these tests have been valid and practical as a basis of program organization and as a measure of pupil progress. After all, "the *test* of the pudding is in the eating"!

Calibration and Uses of Fitness Tests in Westmount High School, Quebec

By Kenneth H. Murray

1. Too many claims of results in physical education, whether in health, morals, or social traits, have been guess work. We physical educators have hoped or believed improvement was being made, but we very seldom prove our claims by actual figures.

2. Accurate measurement is absolutely necessary to know where to start the training of the children. We can, of course, give all pupils a certain set program year after year, and usually we do, in spite of the fact that children are different and each one needs different treatment to meet his or her needs. Of course, certain phases of our program are applicable to all; but to get the best results from our work we must know where we start, we must know our destination, and we must measure progress along the way. Otherwise physical education cannot be termed scientific, and therefore cannot claim to be effective in any direction.

3. Tests can become unwieldy and take up too much instruction time to warrant their use. This has often been the fault in the past; and administrators have frowned upon tests for this reason; but this condition is not inevitable. The fact is that such failures of tests are due to another condition: the examiner does not know his ultimate goal, and particularly as related to the tests he gives. If tests are selected in terms of educational aims, if they can be made concise, and if they are properly interpreted and used, they become indispensable. Indeed, as we have observed above, they *are* indispensable to the orderly or certain attainment of any objectives.

4. Only those tests which have definite purposes and are used to attain them should be utilized. Too often, in physical education as well as in academic subjects, tests have been made and nothing done with them. The results have just been filed as a matter of record. ***Tests should result in action.*** They should be used to determine pupils' strong and weak points and the effectiveness of methods of teaching, rather than as ends in themselves. They should, in brief, become guides to the modification of programs.

5. The material presented hereafter reports a first attempt by the writer to put his teaching of physical activities on a scientific basis. The status of each pupil was found by giving prevalidated tests. These same tests were repeated later and the amount of improvement was calculated through proper statistical methods.

6. As a preliminary to testing, the writer calibrated his instruments. Since these procedures are of great importance to any scientific program,

and since physical educators are relatively unfamiliar with them, they are reported in detail here.

7. The material following that on calibration of apparatus shows the results of the first year of work at Westmount. Various teaching programs were tried on the group as a whole to test their values. The results were fairly satisfactory. More specialized work will be carried on for the individual cases since this validation of the program for the whole group has been determined. The results of the "general improvement programs" are shown in this paper.

CALIBRATION OF INSTRUMENTS

The Spirometer.—Calibration was carried out to determine correct graduations on the spirometer, which was of unknown manufacture. It was without a counterbalance but with a light head. The possibility

CHART I

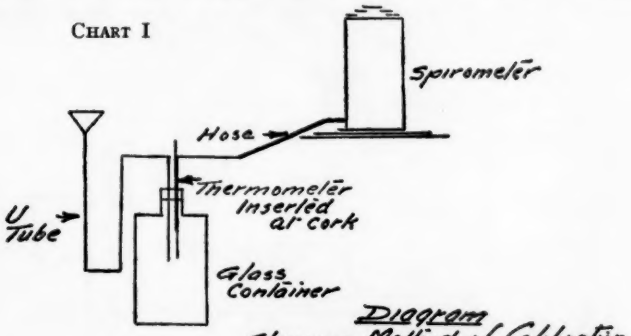


Diagram Showing Method of Calibration

that the manufacturer did not allow for air shrinkage due to the warmer air from the lungs hitting the cold-water-cooled can made a calibration practically necessary for accurate results.

The procedure was as follows, using apparatus as illustrated in Chart I.

1. The temperature of the water in the can was taken and found to be 18 degrees C.

2. 2000 c.c. of warm water were placed in the bottle. This water varied from 50-70 degrees C. This water warmed the bottle and the air in the bottle to 33-34 degrees C. The "U" tube was filled with water and the marker on the can was set at 0 c.c.

3. It was found that water at 54 degrees C. after flowing through the apparatus gave an air temperature of 37.5 degrees C. at the entrance to the rubber tube leading to the spirometer as it would be used in actual practice. Water at 54 degrees C. was poured into the funnel. The water went through the "U" tube, which acted as a check, into the bottle and forced air up into the spirometer.

4. 500 c.c. amounts of 54 degree C. water were poured in the funnel and when through the funnel, the amount the can was raised was marked on a paper strip superimposed over the original readings on the spirometer.

5. Three different tests were taken.

6. The connections were tested under water for air leaks and none were found.

7. Only heated water was used. Time did not permit a trial with cold water to displace the air to see how it compared with the can.

8. One continuous pouring without stopping was also used and was the same as the third reading.

9. Some trouble was found at the start. When the initial air was forced into the spirometer, the distance from 0 to 500 c.c. varied greatly in each test. There was a slackness of varying amounts in the original movement to be taken up. After this was taken up, the steps were constant. To offset this handicap, the scale was moved down so that the can had to receive about 250 c.c. of air before the 0 mark. This meant that pupils taking the test would be required to give a slight blow to take up the slack and have the pointer start at 0.

10. The metric system was used in the experiment because of the lack of a suitable container for measuring the water in the English system. The readings were later converted from metric into the English.

11. Results of testing gave results as reported in Table I.

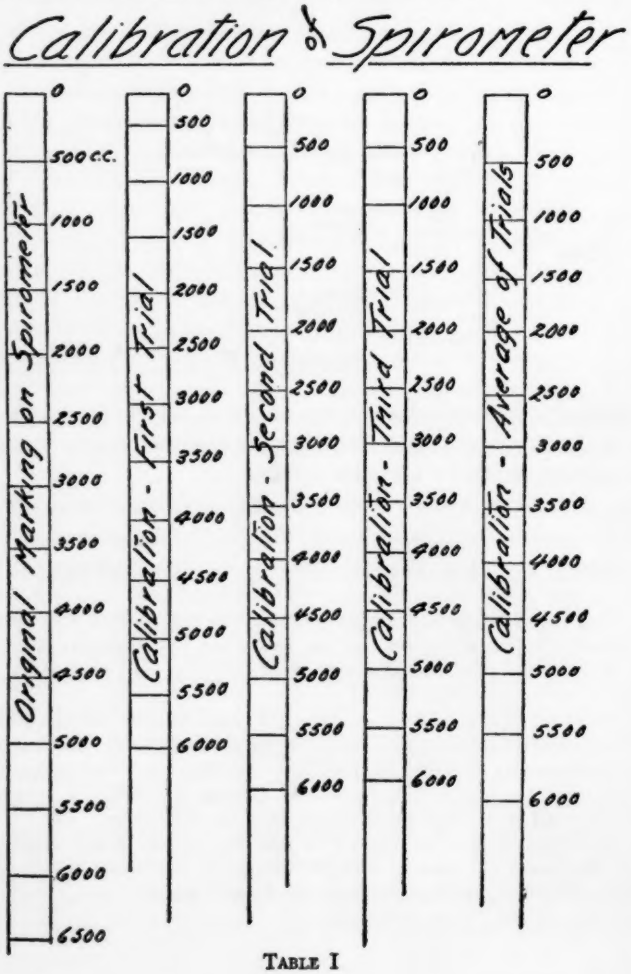
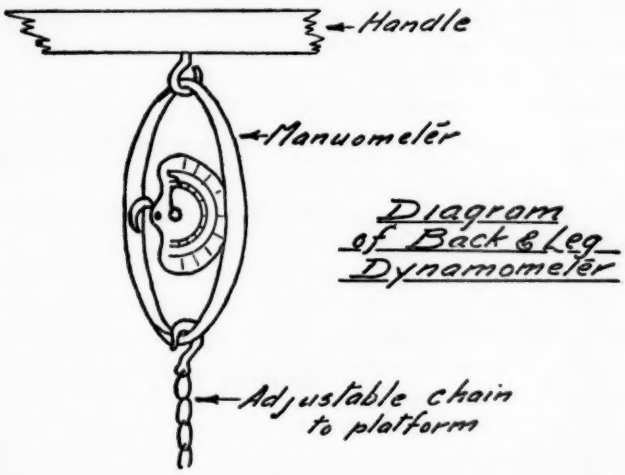


TABLE I

The Back and Leg Dynamometer.—This instrument was unusual in that it was rigged up out of an elliptical manuometer, supplied by the George Tiemann Company of New York. This instrument had been in the department for some years and there was no record of its ever having been tested before.

The use of this instrument for back and leg tests should interest physical educators who find difficulty in securing a hundred dollars or so for the standard back and leg dynamometer. The Tiemann instrument costs about eighteen dollars.



1. This hand dynamometer was hung from a beam by a hook. A large metal bucket of known weight was placed by means of another hook on the bottom of the dynamometer. The weight of the bucket was marked on a paper scale pasted on the face of the dynamometer.

2. Additional weights of fifty pounds each (coal) were placed in the bucket. Each of these additions was marked on a calibrated scale.

3. When the bucket became full of coal, an individual weighed himself and then hung on the chain suspended from the dynamometer. Two persons in addition to the coal was as far as the test was carried, although the scale was marked up to 1000 pounds.[1]

This instrument, as nearly as could be judged, was perfect when properly calibrated.

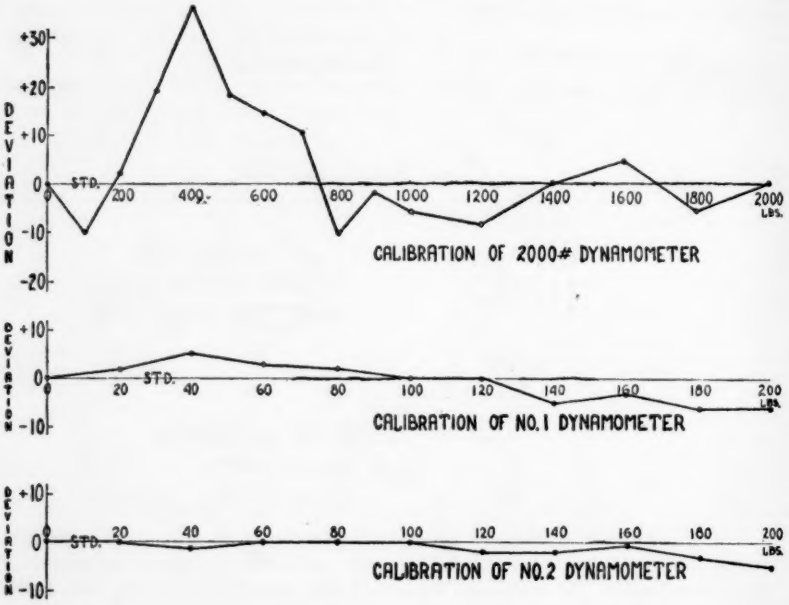
The Manuometer.—This instrument is the same as that calibrated in Section 2—Back and Leg Dynamometer. It was marked for squeezing and pulling. The pulling was calibrated and found correct. The method of calibration for squeezing is to fix the manuometer in a vise and then hang known weights on it, suspending them by strong cord. The writer is indebted to Robert Laveaga of the Huntington Avenue Y.M.C.A., Boston, for Chart II which records the results of calibrating dynamome-

[1] The calibration should have been carried through 1000 pounds. (Ed.)

ters used in his institution. These calibrations were made by Lyman M. Dawes, using standard and highly scientific instruments and demonstrate the need of calibrating equipment. No apparatus should be accepted from factories without checking its accuracy.

PROCEDURES

Tests were given, using the instruments descibed above, in December, 1933, and June, 1934, according to procedures outlined in the manual



Physical Capacity Tests.[2] Following the testing program, the writer conducted his regular physical education program, which stressed the following activities and methods:

In the fall, the activities consist of touch rugby and some soccer. The inside activities are the usual winter team games, basketball, volleyball, and other gymnasium games for one day of the week and apparatus work, with emphasis upon mat work, on the remaining day. In the spring, softball (playground baseball) tennis, track and field are given in the physical education classes.

It should be explained that two forty-minute periods are allotted to physical education each week and that five specially trained student instructors are appointed for each class of thirty pupils. The class work is carried on by these instructors leaving the director free for special work in the class.

[2] A. S. Barnes & Company.

The program was modified from "form programs" to effect changes in physical fitness as follows:

Vigorous exercises were given all the boys for part of each class period of physical education.[3] While team games were being played on the gymnasium floor, the remainder, not playing at the time, were given wall bar exercises for two-thirds of the period. They were really given a strenuous workout which lasted from ten to fifteen minutes each lesson.

Individual pupils' programs were modified as follows:

Those with P.F.I's under one hundred in the December, 1933, test were given slightly more attention than those with P.F.I's of over one hundred, but very little attempt was made in organizing an individualized program for the pupils. The object of the project was to determine the results of the program in increased P.F.I's in the whole group in order to validate the work and the measurement program with a view to individualized work the following year.

RESULTS

1. In this comparison of the December, 1933, and the June, 1934, P.F.I. Test, all records were included regardless of whether pupils decreased, stayed the same, or increased in their Physical Fitness Indices.

2. Three hundred and five boys took both tests. Of these, 48 decreased their P.F.I. in the June test; 5 stayed the same, and 252 increased. The increases and the decreases have been analyzed in detail, but are not reported in this paper.

3. The December average P.F.I. was 102.6 while the June average was 111.59 for the same boys, showing an increase in the school average of 8.99 points or 8 per cent.

4. The middle two-thirds of the boys in the December test scored between 84.3 P.F.I. and 120 P.F.I. The middle two-thirds of the boys in the June test scored between 91.15 P.F.I. and 132.03 P.F.I.

5. A coefficient of correlation of .83 was found between the December, 1933, and the June, 1934, tests. This is not a measure of the reliability of tests but of variation in true fitness during the interval.[4] Many forces contributed to the changes during the six months. Among these the most important were sickness and differences in intensity and quality of training for the improvement of the individual P.F.I.[5]

6. The polygon curves showing P.F.I. distribution of pupils in December and June indicate approximately the same improvement for pupils on all P.F.I. levels. If any significant differences occur, they are a relatively lesser improvement for low P.F.I. pupils and greater improvement for high P.F.I. pupils.

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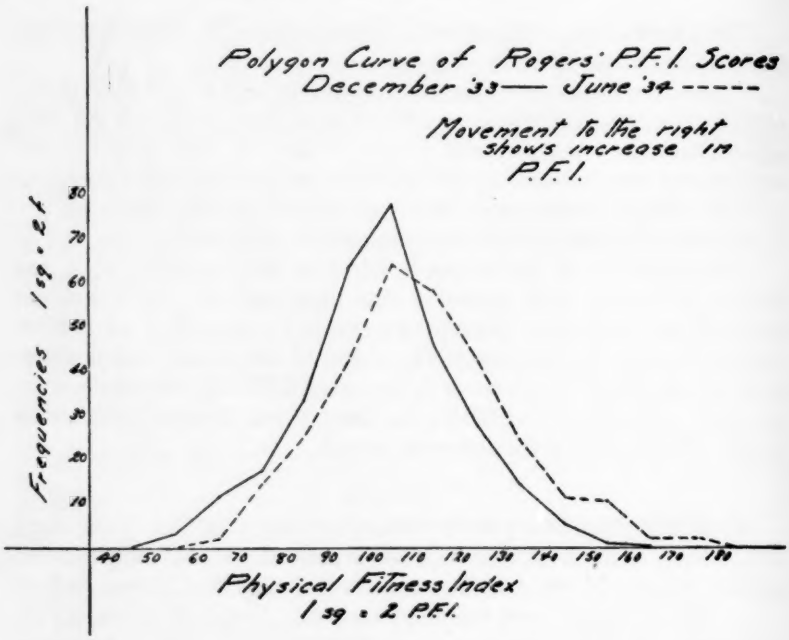
[3] Bukh, *Primary Gymnastics.*

[4] The reliability of P. F. I. tests is approximately .97. This figure has been established by various experimenters working independently.

[5] It is interesting to note that Rogers found practically the same correlation coefficient (.84) for 347 boys for tests made in September 1924 and June 1925 in Montclair, New Jersey. See *Fundamental Administrative Measures in Physical Education*, p. 246.



These conditions are direct consequences of failure to segregate pupils according to P.F.I., so that the director could concentrate on those with low scores. A special effort will be made in the future either to effect segregation into special classes or to separate boys into *P.F.I. squads* and individualize instruction for the low P.F.I. pupils.

7. A few individual records are reported to indicate changes in P.F.I.'s which often occur and problems raised by measurements.

a) P.F.I. 32 in December to 60 in June. Height 73⅝ inches. Weight 196 pounds. Age 14 years, 3 months. This boy is soft and overweight, of the same build as his father. We raised his P.F.I. by reducing his weight and increasing his exercise.

b) P.F.I. 181 to 207. Heigh 66 inches. Weight 125 pounds. Age 14 years, 4 months. This boy is extremely well-built. He has been working too hard in physical education courses. Next fall he will be led *away* from physical activities to protect him from going stale or from a physical breakdown.

c) P.F.I. 32 to 65. Height 66½ inches. Weight 196 pounds. Age 15 years, 4 months. This is a clear case of obesity. The boy was prevailed upon to modify his diet and engage in more exercise. His weight is dropping and his strength increasing —his P.F.I. having *doubled*.

d) P.F.I. 36 to 46. Height 73½ inches. Weight 170 pounds. Age 15 years, 8 months. This boy is about average weight for his height. But he is actually out of proportion, effeminate—probably a glandular case. Very little has been done for him so far, perhaps little can be done without an operation.

e) P.F.I. 49 to 53. Height 69½ inches. Weight 188 pounds. Age 16 years, 9 months. This boy improved very little during the year. He had a "mouthful of rotten teeth" according to his dentist. These have since been removed and the boy should show great improvement in P.F.I.

The Validity of Various Tests as Measures of Motor Ability*

By Elizabeth B. Wellman

EACH year it becomes increasingly apparent that physical education needs more valid and standardized tests of motor abilities to measure the effectiveness of teaching techniques and of teachers and to rate pupil progress more accurately. Moreover, each year teacher-training institutions preparing physical educators realize anew that many of their graduates, because they lack motor ability, cannot secure or hold positions as teachers. The demand for instruments to meet these needs has already yielded a number of standardized tests to measure motor ability; but most of these either lack proven validity or were designed primarily for other purposes than as means of selecting students for teacher-training institutions. The writer, therefore, undertook a study of the validity of various existing tests with the two-fold purpose of determining which was most applicable to measure the motor ability of high school girls and college women and which might be most useful as aids in selecting students for teacher-training institutions.[1]

This study was conducted at the Sargent School of Physical Education of Boston University in 1932–33. It revealed many interesting facts in the comparison of various tests. Certain ones designed to measure "native motor ability" probably fail to do so to any useful degree, while the simplest physical fitness tests prove more valid as measures of actual skill than do tests designed to measure these functions directly. The author here anticipates her conclusions to report that this study amply supports McKinstry's observation [2] that anthropometric tests and particularly those of lung capacity and strength are still our most valid measures of present or future success in physical education, for women as well as for men.

THE CRITERION

The major problem for which a solution was desired was *to discover, among a group of tests of speed, agility, balance, strength, and native motor ability, a test or battery of tests which might be used in restricting admissions to teacher-training schools.* Therefore a criterion had to be chosen as a true measure of "skills necessary for success as physical educators." This criterion was *grades received in physical activity classes*

* This report is an adaptation of a Master's Thesis submitted to the Boston University School of Education in 1933.

[1] The reader should review also Miss Helen McKinstry's excellent report, *A Study of Estimated and Actual Success of Graduates of a Normal College of Physical Education*, Master's Thesis, New York University, 1932. Her bibliography is especially well chosen.

[2] See the source quoted in note 1.

at Sargent School. Although subject to the criticism of "subjectiveness," grades are at present the most definite evidence of students' success in activities at most colleges.

In defense of the use of grades in this study, and for other obvious reasons, the following points are made:

1. No objective criterion was available, for the purpose of the study was to determine the relative value of the most useful objective tests.
2. The grades given were assigned by instructors after at least one year's intimate acquaintance with the students and their work.
3. Grades were given by three or more teachers.
4. Two of the ten sets of grades were entirely objective; they were given by the author in stunts and apparatus activities.
5. Other grades were determined by objective achievement tests in particular functions, by teaching ability, and by theoretic understanding of the subject. Thus these were not truly measures of skill, but included other factors relating to professional ability as instructors in the skills.
6. The fact that the grades were composites of actual skill, teaching success, and theoretical knowledge inevitably reduces the correlation between marks and objective tests of physical abilities of whatever nature. This fact is of great importance in interpreting data.

THE TESTS

The tests used were:

1. The Brace Scale of Motor Ability Tests.[3]
2. The Burpee Test of Motor Agility and Coordination.[4]
3. The Physical Fitness Index.[5]
4. Various activity tests of speed, agility, and balance.

The Brace Test and P.F.I. are too well known to require further description here. The Burpee Test consists of a series of movements from erect standing through squatting to prone fall position and return, executed as many times as possible in ten seconds.

The balance test consisted of a battery taken mainly from the Report of the Committee of the American Physical Education Association, November, 1925.

The agility test was a combination of standing high and broad jump, height of jump being measured from standing-reach height to jumping-reach height, and the broad jump from toe line to heel location at end of jump. Scores were the combined number of inches the body was moved in the two jumps.

The speed test consisted of a two-lap run from a standing start on an oval track with an inside measurement of 157 feet. Times were read to the nearest tenth of a second.

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[3] D. K. Brace, *Measuring Motor Ability.* New York: A. S. Barnes & Co., 1927.

[4] C. H. McCloy, *Measurement of Athletic Power.* New York: A. S. Barnes & Co., 1932.

[5] F. R. Rogers, *Physical Capacity Tests.* New York: A. S. Barnes & Co., 1930.

RELIABILITY OF THE TESTS

The Physical Fitness Index and its component Strength Index have reliability coefficients of .94 to .98, which have been verified by many independent studies. McCloy has found a reliability of .67 for standing broad jump and .74 for the running high jump. It is not unreasonable to expect approximately the same coefficient for the standing high jump. Brace claims one reliability coefficient of .90 for his Scale, but the method by which this coefficient was established is statistically indefensible. His other reliability coefficients ranging between .71 and .82 are probably more nearly correct. Bovard and Cozens report a reliability of .97 for the 100-yard dash. No figures have been offered for the Burpee test. Reliability is unknown for balance tests and honor credits.

Of course, the reliabilities of school grades and marks are known to vary with teachers and schools. The intimate knowledge which Sargent School instructors have of their students renders it likely that the reliabilities of their marks are relatively high. However, the reader should again mark this point: the low reliabilities of school marks inevitably lower correlation coefficients between them and all objective tests of skill or other physical functions.

STATISTICAL TREATMENTS OF DATA

The criterion, "honor credits," was determined for each student by transmitting grades into numbers:

A.....3
B.....2
C.....1

Each student's scores in each physical activity course were then added and the total called "honor credits."

Scoring in objective physical tests was done according to the method prescribed by the author of each. Records were secured for 170 girls.

Data were treated statistically using the Pearson product moment method of correlation and the Yule method of partial and multiple correlation. (See Tables for zero, first, and second order correlations, regression equations, and multiple correlations.)

Honor credits correlated highest with the Physical Fitness Index, the correlation coefficient being .53 and the predictive index 15 per cent. The correlations with this and other tests were as follows:

Test	*Correlation Coefficient*	*Predictive Index*
P.F.I.	.53	.15
Brace	.35	.06
Speed	.39	.08
Agility	.38	.06
Burpee	.37	.07
Balance	.23	.003

It is interesting to note that the P.F.I. correlates with the criterion more than twice as closely as does the Brace Test, which was designed by its author to measure "motor ability," while the P.F.I. was designed chiefly or first to measure "capacity for physical activity." Also, the partial correlation between honor credits and the Brace Test *with P.F.I. held constant* is—.054, showing no relationship between Brace Tests and the criterion *beyond the strength factor.*

The highest correlations obtained between any two tests were between speed and agility .73, and between Brace and P.F.I. .72. The correlation between speed and the Burpee test is surprisingly low, being only .31.

What will be correlations between the criterion and combinations of objective tests?

Using a battery composed of speed, agility, and Burpee, the three least-known tests, the multiple correlation of this battery with honor credits is only .50, indicating that honor credits predicted from this battery will correlate with actual honor credits received .50, or in terms of the Predictive Index, the predicted number of honor credits will be correct in only about 13 per cent of the cases or 2 per cent less than using the P.F.I. alone.

Using the two better-known tests as a battery, i.e., Brace and P.F.I., revealed a coefficient of multiple correlation of only .53, indicating as did the other battery that 13 per cent of the predictions made from this formula will be accurate.

The three tests showing the highest correlations with honor credits were as follows:

Test	*r*
P.F.I.	.53
Speed	.39
Agility	.38

Using these tests as a battery resulted in a multiple correlation coefficient of .56.

The increase of the coefficient of multiple correlation in this battery gave an increase of the Predictive Index from 15 per cent to 17 per cent which may be a worth-while gain if the cost of giving the speed and agility tests is worth an added 2 per cent in validity over the use of the P.F.I. alone.

DISCUSSION

It would seem from the figures presented herein that, from the standpoint of prediction of practical success in terms of honor credits in this school for teachers of physical education, of the tests considered, the combination of Physical Fitness Index, speed, and agility gives the highest predictive power and is therefore the most useful. The multiple correlation of this battery with the criterion being, however, only .56 leaves much to be desired. P.F.I. alone correlates with honor credits .53

which is higher than either of the other batteries and only .03, or 2 per cent lower than the best battery. It seems that the result is not worth the added labor of giving and computing scores from the battery, since the P.F.I. alone will give results very nearly as accurate.

It is interesting to note that the single element with the highest correlation to success as here measured is physical fitness, or *strength in relation to age and weight, speed, and agility*. This seems to indicate that a test of "motor ability" or "motor capacity" might give a more truly representative picture of one's motor powers if it were confined to familiar activities of everyday life, such as weight-lifting, etc., in which the chances are much greater of obtaining a measure of the individual's natural development and real ability, than in stunts or "coordinations," so many of which are unfamiliar to the average person.

The reader is likely to be disappointed in two features of this report —the very low correlations between certain supposedly useful tests of motor ability and the fairly low coefficients in all cases. Concerning the first disappointment, little more need be said, especially since this report merely supports what others have discovered.

On the other hand, it was inevitable that all correlations be low because of the low reliability of the criterion.[6] Unfortunately the exact figure for this function could not be determined, but it would be surprising if it were higher than .85—.90. This higher figure, then, would represent the highest possible correlation between a perfectly reliable objective test of skill and honor credits. This is, in terms of Predictive Index, .564. Then the achieved correlation between Honor Credits and P.F.I. of .53 or P.I. of .13 is really at least twice as high as the P.I. indicates (and is *possibly* four times as high). An upper limit of validity for the various tests as a measure of skill in performing and teaching motor activities is, then:

Test	*P.I.*	*r.*
P.F.I.	.54	.89
Speed	.32	.74
Burpee	.28	.69
Brace	.24	.65
Balance	.01	.14

FURTHER ANALYSIS

Examination of the data involved in this study exposes some interesting facts which, although they had little bearing upon the problem under consideration, are worthy of recording here.

1. Brace classifies the tests in his scale under three main types, i.e. balance, agility, and strength, in the ratio 11:8:7. Transforming the regression equation whose deviation form reads:

Brace score = .37 balance *plus* .13 agility *plus* .004 strength, into its special form by using raw fourth order standard deviations in determining the regression coeffi-

[6] See also discussion by Giauque on page 269 and Park on page 263. (Ed.)

cients (i.e. considering all zero order standard deviations as equal), the equation reads:

Brace score = .25 balance *plus* .41 agility *plus* .35 strength Assuming that our tests of balance, agility, and strength are valid, we now have a real picture of the weight of each variable in determining the Brace score, the weights being practically 3:4:4 as compared with 11:8:7. In other words, statistical analysis shows strength and agility playing a larger part in the test score than balance, although Brace states that balance is involved to a greater extent than either of the other two variables. Since the coefficient of multiple correlation in this case is .76, or P.I. .35, falling short about 70 per cent of perfect correlation, in terms of Predictive Index, we may assume that chance and other factors are involved in the scale even to a greater extent than balance, strength, and agility.

It should be noted that the correlation between honor credits and the Brace Scale drops when strength in the form of Physical Fitness Index is held constant by partial correlation formulae—from .35 to —.054 —which indicates that the Brace Scale is even more highly dependent upon strength for its validity as a measure of any physical quality than the analytic regression equation shows.

2. The following data show first order correlation coefficients and the amount of their reduction from the zero order figures by elimination from the relationship of some contributing factor:

				First Order Correlation	*Zero Order Coefficient*	*Reduction*
1.	Honor Credits and Brace	w. P.F.I.	constant	—.054	.35	115.5%
2.	Honor Credits and speed	w. agility	constant	.05	.39	87 %
3.	Burpee and agility	w. speed	constant	.05	.26	81 %
4.	Honor Credits and agility	w. speed	constant	.16	.38	58 %
5.	Honor Credits and P.F.I.	w. speed	constant	.39	.53	26 %
6.	Agility and speed	w. P.F.I.	constant	.59	.73	19 %
7.	Burpee and speed	w. agility	constant	.28	.31	9.7%
8.	Brace and strength	w. agility	constant	.56	.61	8.2%
9.	Brace and P.F.I.	w. Honor Credits	constant	.67	.72	6.8%

The greatest reductions appear between honor credits and the Brace Scale when the Physical Fitness Index is constant; and honor credits and speed with agility constant. Reduction is to be expected in these partial coefficients when the zero order correlation between Physical Fitness Index and Brace, and between speed and agility are so high, being .72 and .73 respectively.

3. A check on the reliability of honor credits was sought by having instructors rank students in their estimates of students' abilities. These were then correlated with honor credits. The coefficient was .72, which indicates that the reliability of honor credit scores must have been very much higher.

4. The most apparent—though least anticipated—outcome of the study was the demonstration of the validity of physical fitness tests as measures even of motor skills and teaching abilities. However, a little

reasoning will reveal how true this conclusion must be. All life functions depend on physical fitness; and the greater the physical fitness, the greater the potential life efficiency. It has repeatedly been shown in other fields. Even to perform any motor act, strength is necessary. The correlations between strength and speed of running, skating, swimming, and team game abilities for boys have been shown to be very high in literally scores of experiments.[7] Only recently[8] the following correlation coefficients were found between *"ability or speed in learning the kip or upstart"* and

	r.	*P.I.*
Physical Fitness Index	.83	.45
Strength Index	.78	.37
Brace Test	.52	.16

4. The relatively close relationships between physical fitness tests and the criterion suggested further investigations in the physical fitness testing field. The correlation coefficients found are reported in Table I below for the information of researchers in this field.

5. It should be recorded that none of the tests were given under the supervision of their authors or supporters.

6. Data upon which the conclusions of this study are based are included in Table I.

TABLE I

CORRELATION COEFFICIENTS

	r.	*P.I.*
Strength Index and Intelligence	.016	.00
P.F.I. with Intelligence	.015	.00
P.F.I. with S.I.	.68	.27
Honor Credits with (P.F.I. + I.Q.)	.45	.11
Honor Credits with $(\frac{\text{S.I.}}{10} + \text{P.F.I.} + \text{I.Q.})$	.485	.13
Honor Credits with $(\frac{\text{S.I.}}{10} + \text{I.Q.})$	.43	.09
Honor Credits with $(\frac{\text{P.F.I.}}{2} + \text{I.Q.})$	.32	.06

TABLE II

TEST SCORE MEANS AND STANDARD DEVIATIONS

Test	*Mean*	*Standard Deviation*
P.F.I.	107.01	24.6
Burpee	6.35	.665
Brace	10.78	2.85
Speed	21.515	1.31
Agility	83.05	9.0
Balance	13.27	1.8
Honor Credits	20.28	4.3
Ranking	6.43	1.7

[7] See particularly Part III of this supplement.

[8] Clayton T. Shay, "The Progressive Part versus the Whole Method of Learning Motor Skills," RESEARCH QUARTERLY (December, 1934), 66.

The Selection of Physical Tests for Measuring Y.M.C.A. Secretaries[1]

By V. F. Hernlund

THE PURPOSE of the research reported here was to determine the most useful tests to give Y.M.C.A. secretaries to measure their physical fitness for their work. The value of truly valid tests must be very great, for the efficiency of Y.M.C.A. secretaries as well as other administrative officers depends primarily on their physical powers—which often are ignored when selections, transfers, and promotions are made.

THE TESTS

Tests were administered as follows:

1. An electrocardiographic record was secured of each subject's heart action.

2. A test of cardiovascular reaction was administered, using the *Schneider Cardiovascular Test of Physical Efficiency*, the *Foster Test of Efficiency*, and the *Barach Energy Index*.

3. Complete, detailed physical and medical examinations were given, using different methods and securing somewhat different data for (*a*) Indiana secretaries, and (*b*) Ohio secretaries.

4. Strength tests were administered using standard instruments and techniques according to *Physical Capacity Tests, A Manual of Testing Techniques*.

5. Examination of urine.

TESTING PROCEDURES

Indiana.—Tests were given in examination rooms of different Y.M.C.A. buildings in the state. The following cities were visited in the order named: South Bend, Gary, Fort Wayne, Newcastle, Indianapolis, and Lafayette. These cities served as examination centers, each secretary going for examination to that city which was closest to his place of employment.

All tests were given by the same two examiners.

The medical history sheets were filled out when the subject first reported for the examination.

The electrocardiographic record was then taken and the subject told to report to the next examiner in another room.

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[1] This report is a bare summary of several studies. The research was made possible through a special grant of the Laura Spellman Rockefeller Foundation to the George Williams College, Chicago, and with the cooperation of the Y.M.C.A. Graduate School, Nashville, Tenn.

For the remainder of the examination all clothing was removed and the cardiovascular test administered at once. The routine physical and medical examination followed and then the strength test was administered. A urine specimen was left in the examination room. In the tests given to the Indiana secretaries, quantitative glucose and creatinine determinations were run on three hour samples of urine, using a calorimetric technique. Specific gravity, reaction, albumen, and total volume were also recorded. To make the three-hour collection of urine possible, wide mouth specimen bottles were mailed directly to all the secretaries with instructions for collecting and keeping cool the sample of urine on the day of the examination. Subjects brought their specimens with them to the examination rooms. They were kept cool and analyzed at the close of the day.

The general secretaries at the examination centers visited made possible the scheduling of subjects at regular intervals of time. The entire test exclusive of the urinalysis required from forty to fifty minutes.

Ohio.—One examiner performed all the testing procedures. Examination centers were in the following cities visited in the order named: Toledo, Tiffin, Cleveland, Akron, Canton, Dayton, and a second series at Cleveland and Toledo.

The same routine was followed as in the examinations in Indiana excepting that the entire procedure was performed in one room. The urinalysis consisted of the examination of a specimen voided in the examination room. Qualitative glucose and albumen were run as well as total volume, specific gravity, and reaction.

INDIANA RESULTS

In the earlier work on the student body at the Y.M.C.A. College in Chicago and also on the tests administered in Indiana it was apparent that light-weight but well-muscled individuals had quite an advantage over subjects who had about the same musculature but carried in addition an extra load of weight in the form of subcutaneous fat. The Physical Fitness Index scores of two such subjects were usually widely separated.[2] Dr. C. H. McCloy of Iowa University had been experimenting with a new method of scoring the push-ups and pull-ups to equalize these factors. Prior to the publication of his article in the *Research Quarterly* of December, 1931, he had allowed the writer to use the formula he later published, in comparing the records of the two types of individuals mentioned above.

It was found that the total score of the heavier individuals using the new method of scoring "strength of shoulders" was raised considerably, while scores of lighter subjects either remained the same or dropped.

[2] And quite properly so according to the philosophy of the P.F.I. as established and used in public schools. Mr. Hernlund's scoring technique gives a slightly different meaning to P.F.I.'s. In particular and for example, overweight individuals are not so forcibly warned of their deficiencies by the Hernlund-McCloy scoring techniques. (Ed.)

The new method seemed to have possibilities in dealing with older individuals who usually carry more excess fat than the average college student. Both methods of scoring were eventually tried, however.

Strength Index scores were first calculated on all of the Indiana data using both the standard and new methods. Table I reports the scores of Indiana men in the various tests, including the P.F.I. scores, using as norms for strength, norm tables based on tests given the Y.M.C.A. secretaries. It should be remembered too that because of the decided difference in strength test items and strength test scores of the physical education students and other secretarial students at the Y.M.C.A. College, Chicago, the groups were treated separately. A table of norms was established for each group. It seemed logical that norms for physical education students in college would be the norms to use for physical directors in the field. Likewise the norms for secretarial students would serve other than physical director secretaries in the field. The average P.F.I. for the Indiana group was 92. This included physical directors as well as other secretaries.

Subjective evidence noted in the examining room indicated that the value 92 was a relatively low figure for the average in Indiana. The examiner having seen and examined both groups decided to apply the new method of scoring strength of shoulders. This treatment of the strength records on the Indiana group was not made, however, until after the Ohio group had been examined.

The Health Score.—Table I reports the health scores calculated from the findings on the medical examination blank. The scoring method was developed by Dr. G. G. Deaver, Y.M.C.A. College, Chicago. The complete medical blank and the scoring system were published in the *Journal of Physical Education* in February, March, and April of 1930. The average score of the Indiana secretaries is 95.5. A score of 100 represents the ideal subject medically and physically from both a structural and functional viewpoint.

The Cardiovascular Tests.—A cardiovascular test score was not applied to the Indiana records because no adequate scoring device for the test used was found. A special cardiovascular technique was used because no adequate test of cardiovascular efficiency had as yet been discovered. The technique in the present test supplied everything that other tests have supplied and it was therefore administered to the group as a possible means of throwing more light on the entire matter. Table II shows the extent to which abnormalities in the cardiovascular records assembled were present. All of the subjects had electrocardiographic records taken of their hearts.

It should be noted that there were seven of these cardiovascular records pronounced abnormal or indicative of cardiac impairment. Only three of the seven are to be found among the list of other cardiac abnor-

TABLE I

SUMMARY SHEET OF DATA SECURED IN THE EXAMINATION OF Y.M.C.A. SECRETARIES IN THE STATE OF INDIANA

Subject	Age	Ht.	Wt.	Ach. Str. Index	Physical Fit. Index Old	Physical Fit. Index New	Health Score Old	Health Score New
1	31	67.4	138	1762	103	107	91.5	96
2	22	72⅞	162	1970	105	110	91	96.5
3	25	70⅛	158½	2016	110	114		95
4	23	68⅜	180½	Has recurrent disloc. shoulder			86.5	87.5
5	48	66¼	145½	1695	86	100	93	97
6	46	71	195	2228	86	111	93	97.5
7	31	69.3	172	1722	69	93	94	95
8	27	67½	140	1762	102	106	94	98.5
9	33	70¾	202½	1664	54	81	86	94
10	36	73	192½	Could not do back and leg lift			91½	96
11	38	70.2	176	2548	144	135	96.5	97
12	21	68¼	152½	Did not do pushups			91	95.5
13	29	68½	168	2421	123	132	95.5	96.5
14	29	68⅜	151¾	1686	82	97	93.5	95
15	24	67	142	1527	74	92	90.5	95.5
16	22	69¼	210	1151	50	55	87	89.5
17	22	Did not do strength test.					96	98
18	23	68⅝	146	1938	114	114	93.5	98
19	51	68¼	135	1785	102	110	84.5	91
20	34	68	128	1593	93	101	92.5	95.5
21	32	65¾	177¼	2027	88	107	93.5	95
22	35	69⅞	142	1441	74	86	91.5	94.5
23	44	69½	160	2346	123	132	94	98
24	27	68	126	1525	88	97	97	97
25	24	76	186	2207	95	113	95.5	97.5
26	25	70½	152	1779	85	103	87.5	93
27	48	72½	167	1848	81	101	91.5	97
28	37	68¾	145¾	1751	100	104	97	99.5
29	22	70.8	166	2154	112	118	98	100
30	36	69⅛	161	1821	89	102	94.5	97
31	26	72	170	1974	103	108	96.5	100
32	18	65½	147	1775	110	116	95.5	98
33	26	69⅜	175½	2136	94	114	90	94.5
34	28	66	121	1638	117	107	95.5	95.5
35	31	72.7	200½	2159	85	106	93	98
36	59	68½	160	916	53	51	91.5	95.5
37	34	66½	159	2015	114	114	97	97
38	32	69½	139	1423	76	86	94	94.5
39	40	72.4	189	1801	66	91	94.5	96.5
40	69	64⅝	149¾	Did not do pushups			89.5	92.5
41	16	71⅜	156¼	1809	99	103	94	96.5
42	47	68⅝	168	1762	76	96	93.5	95.5
43	44	67	141⅞	1865	109	112	93.5	98
44	26	68½	146½	1852	98	109	89	91.5
45	31	69	171	2012	88	109	98.5	99.5

TABLE I (Continued)

SUMMARY SHEET OF DATA SECURED IN THE EXAMINATION OF Y.M.C.A. SECRETARIES IN THE STATE OF INDIANA

Subject	Age	Ht.	Wt.	Ach. Str. Index	Physical Fit. Index Old	Physical Fit. Index New	Health Score Old	Health Score New
46	44	66.8	178	1871	75	99	92.5	95.5
47	39	68⅛	174½	1772	71	95	93.5	97.5
48	50	71	168	Did not do Arm Str.			87	92.5
49	32	Paraplegia-uses wheel chair					85.5	91.5
50	40	69¼	223	2118	69	97	94	95
51	18	65¾	162½	1724	74	96	91.5	93.5
52	21	70¾	158¾	1953	103	110	94.5	97
53	39	66	165	1670	70	92	85	89
54	38	67.7	175.5	1695	66	90	92	95.5
55	35	69⅛	167	2337	116	128	92.5	97
56	29	70½	156¼	1947	96	111	87	94
57	20	68.4	184	1868	72	96	89.5	92.5
58	40	69.8	170	1758	75	95	93	94
59	53	65.5	172	1593	62	86	90	92
60	34	67.3	140	1822	104	110	94.5	94.5
61	30	70.2	149	Did not do str. test			83.5	90.5
62	25	66.5	146½	1788	90	105	95.5	97.5
63	31	69⅛	167½	1870	92	102	94.5	97
64	41	64.8	184	1438	61	74	96.5	89.5
65	23	67⅞	135	Did not do pushups			94	97
66	24	64.1	123	1551	96	100	89	92.5
67	42	68.8	168.5	1888	91	103	93.5	96
68	31	68.3	163	1903	92	106	97.5	98
69	25	68.6	139	Did not do pushups			91	94
70	42	71¼	188	2202	91	112	92	97
71	49	70½	180	1556	58	81	82	86
72	29	62	113½	1574	104	106	97	98
73	30	70¼	178	2006	81	106	95	94.5
74	23	71	172	2168	113	117	93	94.5
75	38	68¾	184½	1812	68	94	92	93.5
76	—	67½	163	2250	121	125	No record of blank	
77	53	69¼	194	1193	55	60	85	89½
78	35	65⅜	168	1820	76	99	83	89
79	28	66.9	171	1673	71	91	91.5	92.5
80	44	66	134½	1269	63	78	82.5	89
81	30-11	67½	151	1706	83	99	91.5	94

malities. Two of the subjects failed to have a return of the pulse rate to the standing rate within two minutes after exercise. The other subject had a systolic blood pressure slightly above 140. The case of the systolic murmur was apparently sufficiently compensated so that it did not show as an abnormality on the electrocardiographic records. The 4 subjects remaining had very normal findings on the other items in the cardiovascular test.

It would seem from these findings that the electrocardiographic record is indispensable in a complete diagnosis of cardiac impairment. However, indications are also present here that the electrocardiogram alone may not be sufficient to give a complete picture of cardiovascular efficiency.

TABLE II

ABNORMALITIES FOUND IN THE CARDIOVASCULAR REACTIONS OF THE ONE HUNDRED FORTY-NINE SECRETARIES EXAMINED IN INDIANA AND OHIO

	Indiana	*Ohio*
Ret. of pulse rate after Ex. required longer than 2 minutes	11	0
Systolic Bl. Pr. St. above 140	3	1
Diastolic Bl. Pr. St. above 90	0	1
Systolic Bl. Pr. St. below 100	3	1
Diastolic Bl. Pr. St. below 60	3	0
Heart Murmurs	1	3
Abnormal electrocardiographic records	7	

Urinalyses.—In the quantitative glucose determinations on three-hour samples of urine only one abnormal record was obtained.

Creatinine determinations failed to show any consistent relation between the total strength and creatinine or between body weight and creatinine. Earlier work by the writer had shown a very constant relation between body weight and total creatinine by this same method. The writer believes that the three-hour sample both for the glucose determinations and the creatinine findings is not a satisfactory sample of the twenty-four hour output of urine.

OHIO RESULTS

Strength Tests.—The achieved Strength Index score on these records has been calculated using the McCloy formula for strength of the shoulder girdle muscles. Table III reports test scores for the Ohio men. The table of norms by which P.F.I. scores were calculated on these records was prepared by grouping all of the Indiana and Ohio strength test scores. In these scores strength of shoulders was calculated using the McCloy formula. The correlation between the total strength and body weight was determined and a regression equation used to predict total strength when body weight was known. A frequency distribution of the revised strength test scores and physical fitness scores for the Indiana secretaries is shown in Table III.

Cardiovascular Data.—Table II has shown the number of abnormalities of the Ohio group compared with the Indiana group. The Ohio groups have a surprisingly small number of abnormalities present judging from this table. No explanation is given for the difference between the two groups. Perhaps the group as a whole was in better vascular condition than the Indiana group. It is possible that this is evidence that the "new P.F.I." ratings are not as true indices of physical condition as the standard formula and norms, for P.F.I.'s of Indiana men calculated

by the standard formula averaged ninety-two or three points lower than the Ohio group, whereas by the new P.F.I. formula they average six points higher. Electrocardiographic records on the Ohio subjects have not been interpreted accurately enough to make a statement regarding them.

TABLE III

SUMMARY SHEET OF DATA SECURED IN THE EXAMINATION OF Y.M.C.A. SECRETARIES IN THE STATE OF OHIO

	Age	Ht.	Wt.	Achieved Str. Index	New Physical Fit. Index	Health Score
1	54–4½	67.5	153	1682	97	95
2	54–5	64	138	1483	90	95
3	37–1	68¾	169	1548	84	91.5
4	44–8	74	205	2301	111	97
5	29–9	64⅝	119	1388	91	93.5
6	—	68	185	Had severe Varicocele		92
7	27–3	68	155	1452	83	95
8	—	65½	128	1613	102	98
9	—	66¾	145	1586	94	96.5
10	—	68	154½	2143	122	98
11	—	67½	153	1916	110	96
12	30–3	74	200	2004	98	98.5
13	61–3	66	142	Did not do.		89
14	34–0	71½	183	1514	78	96.5
15	36	68	136½	1411	87	95.5
16	26–10	71½	173	1845	99	97.5
17	28–9	67.9	130	1501	94	95
18	48	68⅝	198	Had hernia		91
19	26–3	69¼	136	1748	107	95
20	23–3½	69.9	138	1723	105	93.5
21	31–2	68	176	1872	99	98
22	44–6	68	175	1240	66	92
23	39–10	69.6	165	1694	93	94
24	40–10	64.4	138	1638	99	97
25	—	68½	196	2068	103	98
26	28	70.8	138	1514	92	94
27	45–9	68½	134	1422	88	91
28	39–7	65	160	1835	103	96
29	29–9	68½	166	1323	73	92
30	44–2	67.2	142½	1071	64	88.5
31	—	70⅛	136½	1637	100	93.5
32	32–4	63.4	142	1685	101	98
33	24–2	69½	183	1856	96	93.5
34	24–11	—	130	1567	98	96
35	24–1	71	155	1735	99	96
36	35–2	70.1	176	1953	105	96.5
37	38	62.2	135	1275	79	97.5
38	30–11	67.5	163	1705	95	98.5
39	38–2	66.1	162	1772	99	98.5
40	33–6	65½	135	Did not do.		97

TABLE III (continued)
SUMMARY SHEET OF DATA SECURED IN THE EXAMINATION OF Y.M.C.A. SECRETARIES IN THE STATE OF OHIO

	Age	Ht.	Wt.	Achieved Str. Index	New Physical Fit. Index	Health Score
41	26–3	68¼	158½	1963	110	94.5
42	29–7	70	148¼	1825	107	96.5
43	31	67½	160	2112	118	97
44	34–9	67	127½	1305	83	95.5
45	—	70	186½	1983	101	96.5
46	39–10	73	174	1839	98	97
47	32–10	70.1	177¼	1757	93	98
48	27–10	72¾	176½	1739	92	97.5
49	—	67½	166	1913	105	97
50	24–10	73	175	1732	92	94
51	—	—	137½	1561	95	97.5
52	26–3	67.6	152	1985	115	98.5
53	38–9	66⅜	186	1464	72	91
54	—	65.5	133¼	1489	92	94
55	32–8	72	130	1681	106	88
56	42–10	66.3	144	1623	97	94.5
57	35–7	66	143½	1673	99	96.5
58	—	71	215	1703	80	95
59	30–6	67½	162	1210	90	98.5
60	—	73	204½	1967	95	93.5
61	55	65.2	170	Did not do Str. Test.		91.5
62	24–3	70½	160	1714	96	95.5

Physical and Medical Examination—Health Scores.—Following the examination of the Indiana secretaries in December, 1929, summaries of their findings and their scores were mailed to all of the subjects. Several responses regarding low health scores were received in reply to the statements mailed. Subjects wanted to know why they were given scores as low as eighty and eighty-five when they were "perfectly well" and "had not missed a day's work on the job in years." Some of the subjects mentioned statements made by their own physicians pronouncing them to be in perfect health.

A careful re-examination of all of the Indiana examination blanks revealed several things. Most apparent in the records of the subjects writing about their scores was the fact that in every instance the subject had been penalized on his health score for defects which had been corrected. This, however, was in keeping with the scoring system by which they were being compared to the ideal person from a structural and functional viewpoint of health. These inquiries caused further investigation to see if it was advisable to use the structural ideal as the best guide to determine whether or not a high score was closely related to efficiency to perform one's tasks well. Several attempts at revision were made.

Finally, with the assistance of Dr. T. Zerfoss, Director of Student Health Service, Vanderbilt University, Nashville, Tennessee, a revised scoring system was constructed for the medical blank, the aim of the new scoring system being to penalize those factors showing abnormalities from a functional viewpoint. If they had been corrected by proper medical attention no penalty by a reduction in score was made. The ability of a man to perform his daily duties was considered paramount. Anything which interfered with maximum function should be penalized. If an individual had 20/40 vision with astigmatism and the defects had been corrected by properly fitted glasses the subject was not to have any points deducted from his health score, for these items. On the other basis of scoring the same subject would lose two points from his score. In a similar manner, if an individual had bowlegs and no sign of muscular weakness in these extremities he was not penalized. On the old basis he lost one point. If an individual had bad posture on the old scoring device and a spinal deformity as well, he lost points for both conditions. In the revised scoring system only the deformity itself was penalized. A subject was not penalized if he had had many cavities in his teeth providing they had received proper attention. Other changes in the scoring system as it was developed by Dr. Deaver were made. They all had a similar objective in mind, i.e., to penalize where *function* of the individual on his job might be impaired.[3]

The revised scoring system was first tried on a group of Vanderbilt University students. The results seemed more adequately to place individuals in relation to their health and ability to function efficiently on the job. All of the factors referred to above were kept in mind at the time of the Ohio examinations.

Urinalyses.—Examination of urine specimens on the Ohio secretaries revealed only one suspicious glycosuria. No albuminurias were found.

Composite Treatment of Indiana and Ohio Data.—The Indiana and Ohio test records were then placed together as one group representing the secretaries in the field.

Table IV shows the mean scores for test records on the combined groups as well as each group separately.

SUMMARY AND CONCLUSIONS

The batteries of tests selected were administered to 142 Y.M.C.A. secretaries in the field. A revised method of scoring strength of shoulders in the strength test was used, which does not interfere with the reliability coefficients of the strength test as administered. The

[3] The significance of this change in scoring medical examinations is well nigh overwhelming in its evidence that strength tests may be the most significant of all physical measures. For strength tests are the functional tests which measure the most necessary and universal of all performance: physical activity. (Ed.)

S. I. scores calculated using the new formula for strength of shoulders show a normal distribution among the subjects examined. A table of normal strength index scores for body weight has been constructed using the records of the secretaries in the field. P. F. I. scores calculated using these norms, present a normal distribution.

A revised method of determining health scores was used. Evidence was found (though not reported here) to indicate that the new scoring method which measures *functions* more nearly measures the present health condition of the subjects than does the old method which emphasized structure.

Qualitative urinalyses seem to provide sufficient information for this section of the testing procedure. The three-hour sample of urine ana-

TABLE IV

SUMMARY OF THE MEAN SCORES ON FREQUENCY DISTRIBUTIONS OF TESTS GIVEN TO INDIANA AND OHIO Y.M.C.A. SECRETARIES

	Strength Index Mean Score	Physical Fit. Index Mean Score	Health Score Mean Score
Indiana	1832	102.0	95.3
Ohio	1655	95.9	95.4
Indiana & Ohio Scores combined	1771	99.4	95.36

lyzed on the Indiana tests does not provide an adequate index of the creatinine over a twenty-four-hour period.

The cardiovascular test applied to the secretaries in the field (details concerning the very low reliability and consequent greater lack of validity of cardiovascular tests as measures of heart function for individuals who have no serious cardiac deficiency are included in an article soon to be published) revealed at least one significant fact. The tests as applied (Foster, Crampton, Barach) have been shown to miss entirely suspected cardiac impairment which was later revealed through the electrocardiographic record. However, the electrocardiographic records have also been shown to fail to record abnormalities which are generally accepted in the medical world as borderline cases indicating possible cardiac impairment.

The following conclusions seem warranted:

1. The revised strength test and P.F.I. may be satisfactorily used as instruments to compare the gross muscle strength and physical fitness of individuals or groups in this study. The more we investigated tests of physical efficiency the more apparent does it become that the P.F.I. is a measure of very high validity and possesses many special, if not unique, merits as a measure of the efficiency of the human body.

2. To use the P.F.I. for Y.M.C.A. secretaries, norms of strength

should be established in terms of new arm strength scoring and using the records of Y.M.C.A. secretaries.

3. Revised methods of determining health scores should be utilized in all estimates of health based on physical and medical examinations. It is particularly important that the revision emphasize function rather than or above structure.

4. That the tests of cardiovascular efficiency are not adequate for comparative purposes between individuals or groups who are relatively normal otherwise.

5. That at the time of this experimental work no adequate test of cardiovascular efficiency exists for use by physical educators or others giving routine examinations to Y.M.C.A. secretaries, and that further statistical work should be carried on.

An Experiment in the Psychology of Competition*

By Harold L. Berridge

WHOEVER has been associated with physical education or athletics has frequently found individuals who have every characteristic that makes an ideal player except that mental quality which so outstandingly characterizes the competitor. These non-competitive individuals usually outshine their teammates during practice periods, but fail when placed in situations that *demand* superior performance. It was the experimenter's desire to discover the effect of the presence of competitors on performance. Various classes of unselected college men were used, including freshmen, sophomores, and juniors.

THE PROBLEM

Specifically, the problem was "To analyze the effect of competition by measuring performance under three different sets of conditions." *Set one*, alone, without knowledge of the results; *set two*, alone, with knowledge of the results; *set three*, in the company of other performers with the results known and announced so all could hear.

APPARATUS EMPLOYED

A Kellogg back and leg dynamometer was used to obtain all of the data of this experiment.

PROCEDURE

The groups used were four different classes of physical education students taking wrestling for their required work. No varsity, or any candidate for varsity, nor any intramural wrestler was used. No student was included who had ever been a member of any college athletic team. The majority of the students were taking wrestling for the first time. No attempt was made to equalize the groups by predetermining their strength. Sixty-one individuals were tested.

The four classes were divided into different groups hereafter called *A*, *B*, *C*, and *D*. The tests were listed as *set one*, *set two*, *set three*. The order of taking each set of tests was different for each group in order to cancel practice effects.

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* This study emphasizes psychological aspects of testing; nevertheless its significance to physical fitness testers is very great; for it demonstrates the importance of testing pupils under "controlled" conditions; i.e. in the presence of their fellows. Otherwise scores will not be the maximal and therefore will not reflect pupils' true conditions. Nor will they be so reliable. (Ed.)

SET ONE

(*Alone, Without Knowledge of Results*)

Each individual was called into the room with the experimenter and the following instructions read: "I am doing some research work in the fields of psychology and physical education. I want you to try and follow the instructions I give you as closely as you can. This test involves three leg lifts. I want you to lift as much as you can at each lift. The results of this test will not have any effect on your grade for this semester. I want you to stand on the foot rest with the hook between your feet so that it is opposite the large ankle bones. Keep your feet far enough apart to give a comfortable position. Keep your back straight, head erect, and your chest well out. Bend your knees well. After this dynamometer is adjusted take a full breath and lift the handles by holding them in place with your hands and straightening your legs. Be sure to lift *only with your legs*." These instructions were supplemented with a demonstration by the experimenter and a picture from F. R. Rogers' testing manual, *Physical Capacity Tests*.[1] After each lift the amount of the lift was recorded, and in set one the individual was not told of the results.

SET TWO

(*Alone, With Knowledge of the Results*)

In this set the individual was called into the room with the experimenter and if it was the first series of tests to be taken by this individual, the instructions were read and demonstrated. In this set, each lift was recorded and the observed was told the result and asked to try to do better the next trial. It is well to note here that when set two was followed by set one, two weeks were allowed to elapse before beginning the new series in order to allow the subject to forget his previously made score. When the individual was in set one before going to set two he was told what his record was in set one; or if he had been in set three he was told what he made in set three. The only limiting condition in this series was that the subject was alone with the experimenter.

SET THREE

(*In Competition with Others*)

In set three the whole group (*A*, *B*, *C*, or *D*) was brought into the room and the instructions read and demonstrated. Subjects took turns lifting so that no individual lifted twice in succession. As each lift was made the results were announced so that every one could hear. All of the groups without exception gathered around the lifter and the "spirit of competition" was shown by their interest and remarks not only in their own lifts but in others. In case the group started with set three and shifted next to set one, three weeks were allowed to elapse to insure the forgetting of the previous records. In case they began with set two after completing set three they began the new set the following week.

[1] A. S. Barnes & Company, New York.

SOURCES OF ERROR

The largest source of error was the dynamometer used. While it was tested by the Engineering Department at the State College of Washington and was found to be accurate, it was scaled in steps of five kilograms. If the pointer was over half way past a mark the higher figure was recorded. In case the pointer was less than half way the lower figure was recorded.

Practice effects may have entered in. The relative strength of each class taken as a whole may be assumed to have remained constant. Though the differences between lifts may have been influenced by practice, nevertheless the schedule for each group must have at least partially counteracted practice effect.

RESULTS

In mean scores set three scored the highest with set two next and set one scoring the lowest. The mean of set one was 536 pounds, set two, 568 pounds, and set three, 616.5 pounds. The results show that the arrangement of the series or previous practice had practically no influence on the results. Table I shows that in groups *A*, *C*, and *D* the ranks of the individual sets correspond to the ranking of the entire group of sets taken as a whole. Group B varied somewhat from the rest of the groups in that the average score of set one was greater than set two, the difference being 13.5 pounds. With the above exception all sets one scored lower and all sets three scored the highest, with sets two falling in between.

The seemingly close relationship of the various conditions used in this test would lead one to believe that the correlation between sets would be high and positive. Using the Pearson formula, the correlation between sets one and two is .64, and between sets one and three the correlation is .62. The correlation between sets two and three is .75. While the correlations between sets are fairly high, there is enough variation from the distribution of best lifts to consider some of the individual differences revealed in individual analyses.

TABLE I

SCHEDULE OF TESTS

With Average Score in Pounds in Each Group in the Order Tested

Group	No. of Subjects	Set First Scored In	Average Score	Time [1]	Set 2nd Scored In	Average Score	Time [1]	Set 3rd Scored In	Average Score
A	16	2	545	2 wks.	1	542	None	3	635
B	22	3	608	3 wks.	1	587	None	2	574
C	9	1	467	None	2	594	None	3	634
D	14	3	589	None	2	572	3 wks.	1	542

[1] Indicates time allowed to elapse between first and second tests.

INDIVIDUAL VARIATIONS

Of the sixty-one persons scored in the three sets the compilation of best lifts shows that

1. Five individuals made their best lifts in set one.
2. Nine individuals made their best lifts in set two.
3. Forty-four individuals made their best lifts in set three.
4. One individual made equal lifts in sets one and two.
5. One person made equal lifts in sets one and three.
6. Two individuals made equal lifts in sets two and three.
7. It is of the greatest significance that individuals who were familiar with tests from previously being tested in sets two and three were able in set one nearly to approach their best in set three. Thus, the average scores for Group B were 608 in set three followed by 587 for set one, whereas Group C raised their average from 467 in set one to 593.5 in set two and 633.5 in set three. Evidently experience in lifting in competition increases scores greatly in solitary performances.

GENERAL DISCUSSION

In reality the groups involved in this study have been of two distinct types due to the conditions of the test. The groups acting under the conditions of set three are co-acting groups and were subjected to the stimulation of sight and sound (the announcement of the scores made by others) of those doing the same thing that they were going to do. In all kinds of competitive performance we may recognize two social factors. The first is social facilitation, which consists in an increase of response merely from the sight and sound of others making the same movements or trying to do the same thing. The second is rivalry, an emotional reinforcement of movement accompanied by the consciousness of a desire to excel in the performance of the task at hand. The second type was the individuals acting alone with only the knowledge that others were going to perform the same act to stimulate them to greater effort.

In some studies referred to by Allport[2] there has been a number of experiments under various conditions leaning to some definite conclusions as to the effect of a co-acting group on the possible score made. In an experiment reported in reasoning it was found that persons could reason more efficiently when alone than when the entire group was brought together. In the co-acting group, it is found in the experiments referred to above that the average deviation was smaller when the entire group acted together than when the performance was alone.[2]

"Rivalry like social facilitation increases the quantity but does not improve the quality of the output." [2] Triplett's experiment with children turning fishing reels showed that, of forty subjects, twenty of them gained markedly in the competitive trials over their average for solitary

[2] Allport, Floyd Henry. *Social Psychology*, pp. 260–291. Boston: Houghton Mifflin Company, 1924.

work. Ten were little affected by the competition. Ten actually lost in speed under the influence of rivalry. The effect of rivalry like that of social facilitation varies inversely with the ability of the worker. In 1914 Dr. W. Moede published an account of rivalry in speed of tapping and hand grip. Seventeen boys between twelve and fourteen years of age participated. The more rapid tappers made actually lower records when tapping in competition with others than when working alone. The speed of the nine lowest individuals on the other hand showed a distinct social increment. This increment was somewhat larger than the decrement of the more rapid half. By thus reducing the scores of the more rapid and increasing those of the slower workers the individual differences in performance were materially lessened.

While some of the experiments of others show different trends than this experiment there is enough likeness to warrant some investigation into the causes of some of the discrepancies. In a recent study at the State College of Washington [3] it was found that motor ability, as such, measured by a battery of tests, had little or no correlation with mental ability. It was cited above that in the tests in reasoning it was found it was more efficient to reason alone than in groups. One might naturally conclude that in so far as there is no correlation between mental ability measured by intelligence tests, and motor ability measured by a battery of motor tests, neither would we expect to find a test of the nature given in this experiment to correlate with a test of reasoning. Since the experiments mentioned above do not exactly meet the conditions set up in this one, naturally the results would not agree. However, there is a definite trend in this test that suggested future investigation.

CONCLUSIONS

This experiment suggests the possibility of a test to measure temperament in connection with adaptability to athletics. The test used here may not be suitable for such a diagnostic or predictive indication of the individual's competitive temperament. However, it indicates the possibility of predicting the competitive ability by a more refined test yet to be worked out. Such a test must be devised and then given to a large number of individuals who have proved themselves in real situations to be poor and good competitors. With this validation as a basis norms or standards of comparison can be calculated. It is apparent from the results of this experiment that there is some measurable difference in the competitive ability of an individual.

In most of the tests used in the classification of students in physical education or in general education there seems to be little or no recognition of social facilitation in the administration of the test. As the results of this experiment show an appreciable difference in the scores recorded by different individuals under the three sets of conditions, some account

[3] An unpublished thesis. Ben Herron, State College of Washington, Pullman, Washington.

should be taken of the manner of administration of tests in order to control its competitive features.[4]

Some individuals may see in this experiment a gate opening into a field offering a better opportunity to increase the reliability of administrative tests such as the P.F.I. in physical education. While the testing routine described in this report is a crude attempt to measure something heretofore unmeasured, it may open the way to a more refined product that will in some sense measure the individual's adaptability to highly competitive motor activities. Such a test may be of particular advantage, too, in the development of athletic training procedure. Not only will it enable the coach to understand better the attitudes and performances of his players, but he will know to what extent he can depend upon a given player in the "tight" situations.

CONDITIONS FOR FUTURE STUDY

Many refinements of the above study are possible. The organization of parallel groups to be tested over a given length of time by a series of tests under the same conditions as outlined in this study is one alternative. It is also imperative that a more finely scaled instrument be used. A larger number of individuals would also improve the validity of the results. Other tests of validity would be necessary. For example, a number of individuals might be rated according to their competitive ability by members of athletic coaching staffs and physical educators and then tested by a battery of tests under different psychological stimuli, and results correlated.

[4] This has already been done for P.F.I. tests. (Ed.)

A Comparative Study of Three Methods of Measuring Flat and Weak Feet*

By Harold R. Danford

INTRODUCTION

THIS study was undertaken for the purpose of comparing the three most commonly used methods of measuring weak and flat feet, and determining the practicability of the use of the *pedorule* for measuring degrees of flatfootedness.

Next to carious teeth the most common and widely spread forms of physical impairment among the civilized people of today are disorders of the feet. According to Bancroft [1] from 57 to 61 per cent of cases of flat feet become serious enough to be discovered between the ages of ten to twenty-five which shows that young people need special training in the hygiene of the foot during this time, when the neuro-muscular system is immature, and weight is rapidly increased.

Another writer [2] found in examinations of school groups and army recruits that the per cent having true flat feet or sunken arches will average from 6 to 13 while those having weak (but not flat) feet will average from 73 to 78 per cent.

These are real problems for physicians and physical educators in their corrective work, not only in the actual building up of weak and fallen arches, but in their prevention. The most challenging angle to the situation is that the percentage of incidence of weak and flat feet is increasing rapidly.

An examination of present methods of determining weak and flat feet was made in a corrective class. Several cases were called to the writer's attention, in which subjects had been placed in the corrective class "to remedy flat feet" when in reality the subjects merely had "normally" low arches.

These experiences suggested the need of a measure, ***not of the height of the arch itself, but of the position of the foot in relation to the leg.*** To meet this need the *pedorule* was devised. This instrument, in the hands of trained testers, was found to be a valid, reliable, and economical method of measuring weak and flat feet.

This report gives a brief description of three methods of measuring foot conditions and their relative validities.

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* This report is a summary of a Master's Thesis, submitted to the Boston University School of Education in 1934.

[1] Jessie H. Bancroft. *The Posture of School Children.* New York: The Macmillan Company, 1913.

[2] George T. Stafford. *Preventive and Corrective Physical Education.* New York: A. S. Barnes and Company, 1930.

THREE MEASURES OF FOOT CONDITIONS

1. **Subjective Estimates of Examiners.**—This method is doubtless the most widely used in American schools today, the examiner judging the foot subjectively by his own particular method. Following are some of the methods used:

a) Examining the tendon of Achilles to see if it is bowed in.
b) Observing the malleoli and judging their position.
c) Having the subject walk, or stand on one foot.
d) Observing and judging the arch itself, often by placing one or two fingers under the longitudinal arch.

Any or all combinations of the above may be used.

2. **The Pedograph, and Other Methods of Measuring the Ground Plan of the Foot.**—(*a*) The pedograph ranks next to the subjective judgment of examiners in popularity of use. It is a machine which takes an imprint of the ground plan of the foot.

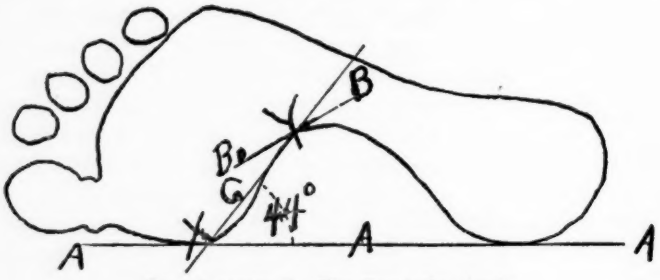

ILLUSTRATION I.—The Footprint Angle

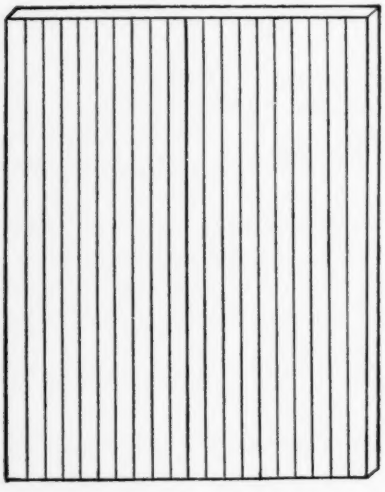

ILLUSTRATION II.—The Pedorule

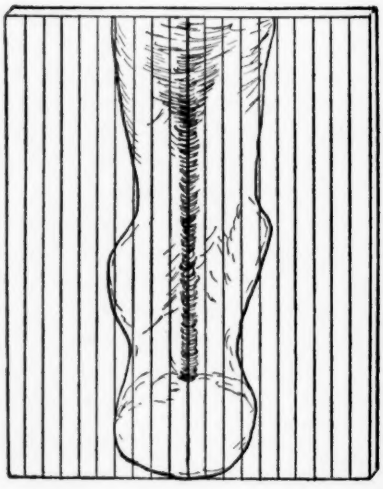

ILLUSTRATION III.—The Pedorule in Testing Position, Showing a Normal Arch—Pedorule Reading Zero

The first attempt to measure footprints was made by Schwartz [3] who originated the footprint angle. This angle is the chief mathematical measure of foot conditions available from footprints. One method of scoring the footprint is shown in the above illustration.

Instructions for scoring footprints by the pedograph: [4]

a) Draw line "A" to represent the medial border of the foot between the points of the imprint at the base of the first metatarsal bone and the calcaneus.

b) Draw line "B" to represent the slope of the inner segment of the longitudinal arch at its junction with the metatarsal border of the arch.

c) Locate points "X" and "Y." "X" is located at the point where line "A" first touches the imprint. "Y" is located at the point where line "B" first touches the metatarsal border of the arch.

d) Draw line "C" between points "X" and "Y." This line is intended to represent the slope of the metatarsal border of the longitudinal arch.

e) Measure the angle at the junction of the lines "A" and "C" with a protractor.

(*b*) Another method of judging the ground plan of the foot is to have the subject walk barefooted on a dusty floor. If the inside of the foot at the bottom of the instep has become dusty, it is a fair indication of the presence of flat foot. A variation of this plan is to judge the print left on the floor by having each subject slightly dampen his feet and then step on the dry floor.

3. **The Pedorule.**—This instrument is a rectangle of heavy plate glass, seven inches wide and nine inches high, with the surface parallel-lined in tenths of inches. ***This pedorule was devised to measure the amount of deflection of the tendon of Achilles from the perpendicular.*** Williams [5] observes "The swelling and fullness along the inner side of the foot are accompanied by a bending inward of the tendon of Achilles. In the normal foot the tendon of Achilles makes a straight line, but in a weak foot the lower end appears to be deflected outward."

a) When the pedorule is placed immediately behind the foot to be measured, two points must be established by ink marks: first, ***the mid-point of the tendon of Achilles as high on the calf of the leg as possible***; and second, ***the mid-point of the back of the heel.***

b) The center line of the pedorule (which for convenience should be colored) should then bisect these two ink marks, on a normal foot.

c) In taking observations one eye should be closed; and the other should be in position approximately twenty-four inches directly behind the center of the pedorule.

d) From here three readings can be made; first, ***from the extreme tip of the external malleolus to the center of the tendon***; second, ***from the internal malleolus to the center of the tendon***; and third, ***the distance from the center of the tendon to the center line of the pedorule.*** (The center line of the pedorule will coincide with the center line of the tendon of Achilles if the arch is neither flat nor weak.)

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[3] Lows Schwartz, R. H. Britten, and L. R. Thompson. *Studies in Physical Development and Posture*, p. 23, No. 179. United States Public Health Bulletin, 1928.

[4] H. Harrison Clarke. "An Objective Method of Measuring the Height of the Longitudinal Arch in Foot Examinations." RESEARCH QUARTERLY IV: 3 (October, 1933).

[5] Jesse Feiring Williams and Whitelaw Reid Morrison, *A Text Book of Physical Education.* Philadelphia and London: W. B. Saunders Company, 1931.

A second method of determining flat-footedness by the pedorule is:

a) To place the center line of the pedorule directly behind the center of the tendon at the point where it is bowed inward the farthest.

b) Counting the number of lines from this point to the tips of the malleoli and subtracting the distance from the tendon to the internal malleolus *from* the distance from the center of the bowed-in tendon to the external malleolus.

c) The distance that the tendon of Achilles deviates from the perpendicular will thus be found.

After experimenting with both methods, the writer has found that the latter method is less confusing and more efficient. The perfect foot would be "zero," thus showing the tendon to be equidistant between the malleoli throughout its entire length.

STATISTICAL ANALYSES

Objectivity.—The objectivity coefficient between experts using subjective judgments was found by the writer to be .58. Of course, this coefficient indicates a serious lack of objectivity, but it may be considered *relatively* high as a coefficient of correlation between subjective examiners, since it agrees closely with the results of an experiment performed by Franzen in 1929.[6] Franzen averaged the correlation coefficients between the judgments of various physicians measuring the nutritional status of children. Their average was .60.

Reliability.—No reliability coefficient was determined for subjective judgments of foot conditions. The reliability coefficient of foot conditions of the pedograph as computed by H. Harrison Clarke was found to be .97, while the objectivity coefficient was found to be .95. The reliability coefficient of the pedorule was found to be .94.

Norms.—Norms for the footprint angle are as yet not well established. Schwartz[7] found that by his method the average angle was "about 45 degrees," while Rogers[8] estimated it to be 40 degrees after examining 300 prints taken from a highly selective group of high school and college students and securing a median of 43 degrees.

Validity.—The validity of the footprint angle as a measure of true weak or flat feet is open to serious question. Quoting from *Hygeia*, September, 1932, "A footprint will indicate whether or not the arch is flat, but weakness of an arch may be present even when the imprint is normal. A strong, fleshy foot may produce an imprint suggesting a flat foot."

Williams and Morrison[9] say, "Feet vary in their shape like other parts of the body; in some the arch is higher than in others. Occasionally the arch may be extremely high or low and still be normal. Much

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[6] J. Raymond Franzen, *Physical Measures of Growth and Nutrition*, Chapters I-III. New York: American Child Health Association.

[7] Lows Schwartz, R. H. Britten, and L. R. Thompson. *Studies in Physical Development and Posture*, p. 23, Number 179. United States Public Health Bulletin, 1928.

[8] Frederick Rand Rogers. *Fundamental Administrative Measures in Physical Education*, page 156.

[9] Jesse Feiring Williams and Whitelaw Reid Morrison. *A Textbook of Physical Education*. Philadelphia and London: W. B. Saunders Company, 1931.

more important than the height of the arch is the position of the foot in relation to the leg." In view of these statements, easily verified by observation and the unanimous opinions of orthopedists, a study of correlations between various forms of testing feet should be significant, *if only to demonstrate the present lack of proved validity of any measure.*

TESTS OF VALIDITY

1. The testing for this study was conducted at the Boston University Gymnasium. The subjects were sixty in number and were members of three University male physical education classes.

2. Each of the three methods of measurement mentioned above was followed. Great care was exercised to keep the results of each examiner and examination secret from each succeeding examiner so that he would not be influenced in his judgments. To accomplish this more effectively, examiners were placed about the gymnasium twenty-five feet apart, in the following order: first, subjective examiner number one; second, subjective examiner number two; third, the pedorule; and fourth, the pedograph.

3. Each of the examiners, except the pedograph operator, recorded his findings, with the subject's name, on a three-by-five-inch card. These cards were kept by each examiner and the subjects went on to the next examiner where the same procedure was followed. The pedograph prints were used for records of these tests.

4. Subjective examiners were asked to place each foot in one of five categories, the first group being the perfect arch, then varying the degrees of flat feet, as "Two," "Three," "Four," and "Five," which was the extreme flat-footed group.

5. Recordings of examinations of the pedorule were made in tenths of inches. The reading of zero on the pedorule signified the perfectly perpendicular tendon of Achilles and a normal arch.

6. The method used in scoring footprints by the pedograph was the same as that so ably described in an article by H. Harrison Clarke[10] of Syracuse University.

7. Correlation coefficients were calculated:

a) Between the two subjective examiners.
b) Between each of the instruments.
c) Between each of the instruments and the examiners.

STATISTICAL RESULTS

1. Unfortunately, no objective or subjective criterion of validity is available to check the validities of the various methods studied. Therefore, intercorrelations among the three are reported, with interpretations thereof by the writer.

[10] H. Harrison Clarke, *Op. cit.*

Table I gives the coefficients obtained.

2. Interpretations of coefficients. It was found that a relatively high correlation existed between the subjective examiners and the pedograph. The reason for this is apparent, since in judging subjectively an examiner notes what portion of the foot does not touch the floor and the pedograph print shows nothing except the ground plan of the foot. Therefore, both were, to a great extent, examining the ground plan of the foot without taking into consideration whether or not the foot was normal, or that it had become flattened.

The correlation coefficient between subjective examiner one and the pedorule was .38 while that between subjective examiner two and the pedorule was four points lower. The higher coefficient between subjective

TABLE I

CORRELATION COEFFICIENTS BETWEEN VARIOUS MEASURES OF FOOT CONDITIONS
(60 Cases)

Method	Subjective One	Subjective Two	Pedograph	Pedorule
Subjective Tester one	x	.58	.54	.38
Subjective Tester two	.58	x	.50	.34
Pedograph	.54	.50	x	.30
Pedorule	.38	.34	.30	x

examiner one and the pedorule was due to the fact that he included in his records the position of the tendon of Achilles in relation to the foot.

The coefficient of .30 between the two instruments, the pedograph and the pedorule, shows that they are not measuring the same thing. (An r of .30 equals a predictive index of only .046.) The pedograph is measuring the footprint angle, not the height of the arch. The pedorule is measuring the distance the tendon has departed from its normal position which shows how far the arch has flattened.

3. Two extreme cases of disagreement between pedograph and pedorule tests tend greatly to verify the belief that the pedorule is the more valid measuring instrument.

a) A fine example of the low arch type of foot was found in one of the cases of this study, a negro boy, whose footprint angle was eleven degrees for each foot. Both subjective examiners placed his foot in group five, the extreme flat group. His pedorule examination showed zero for both feet. Since there was such a wide disagreement between the results, the writer called the subject into conference for questioning. It was learned that he believed he had fallen arches because he had always been told he had. It was also found that he had never suffered any pains in his feet, legs, or back that could possibly be attributed to flat feet.

b) The other extreme was a boy whose footprint angle was forty-two. One subjective expert gave him a rating of "1" while the other classified him in the second group. His pedorule score was "five-tenths" for his right foot and "four-tenths" for his left. Again, such a marked difference brought this subject to the special notice of the writer. He was asked if he had ever had any trouble with his

feet, whereupon he replied that he could not take hikes, or play basketball, or stand on his feet very long at a time, because of severe pains in his feet, legs, and back. When asked if he had ever had headaches he replied, "Yes, very often."

These two cases are inserted merely to illustrated how, by means of the pedorule, conditions can sometimes be discovered which would otherwise remain undiscovered.

4. The reliability coefficient of the pedorule is .94 determined by retesting ninety feet.

5. The economy of the pedorule testing is very high. The instrument may be home-made. No other costs are involved except for record cards and the tester's time of about forty-five seconds for each subject.

6. It has sometimes been suggested that "to measure both feet of an individual is a waste of time." It was found in this study that an average of a large group of feet would show the results not differing more than two or three pedorule points. However, in some cases the right foot might be very flat while the left foot was nearly perfect, and vice versa. Thus "measuring only one foot," would be a highly improper procedure.

Rogers reports a correlation coefficient of only .28 between right and left feet.

7. In this study it was found that the greater the bowing-in of the tendon the flatter was the arch (though of course arches were often recorded as flat by pedograph when tendons were not bowed-in). An extreme case showed the tendon of Achilles bowing-in nine-tenths of an inch from the perpendicular. The arch in this case was quite flat and the case was clearly one of "flat-foot."

8. The writer believes, from his brief experience with the pedorule that it is a more valid measure than any yet found to classify pupils for special activities to correct foot conditions. Of course, the number of cases is too small for authoritative statements. The writer is now gathering these and proposes to report results of further experimentation in 1936.

Advantages of a New Shadow-Silhouettograph Over the Original

By C. H. Hubbard

THE SILHOUETTOGRAPH as a means of testing posture or body mechanics, as developed by Mr. Norman Fradd of Harvard University, is, in the writer's judgment, the best so far devised for the purpose. But the silhouette blots out many significant features of body form which ought to be recorded. Of course, examinations of any kind in any field are worth the time spent in giving them only when results show what one is trying to test. If the examination does not do this, then something is wrong with the technique of testing, or the measuring tool is at fault. At Arnold School in Pittsburgh the writer, with the advice of Dr. Blumer of the Children's Clinic of Sewickley, experimented with a system of lighting which seems to have made the silhouettograph considerably more valuable as a means of recording and measuring body mechanics.

The new type of silhouettograph, described hereafter, was brought about merely by the use of additional lighting devices placed in front of the screen. The actual silhouette is maintained, but in addition there is sufficient light thrown upon the subject so that a shadow picture is possible even on the cheap and quickly developed sensitized paper medium used for silhouettographs.

An important advantage of this type of silhouettograph is the time saved in tabulating the orthopedic record of the individual. The new shadow-silhouettograph is sufficiently clear for the examiner to measure and record findings on the examination card at his leisure and thus save the detailed measurements usually made at the time the individual is being examined. The shadow-silhouettograph then can remain in the files for later study and action.

ADVANTAGES OF THE NEW SHADOW-SILHOUETTOGRAPH

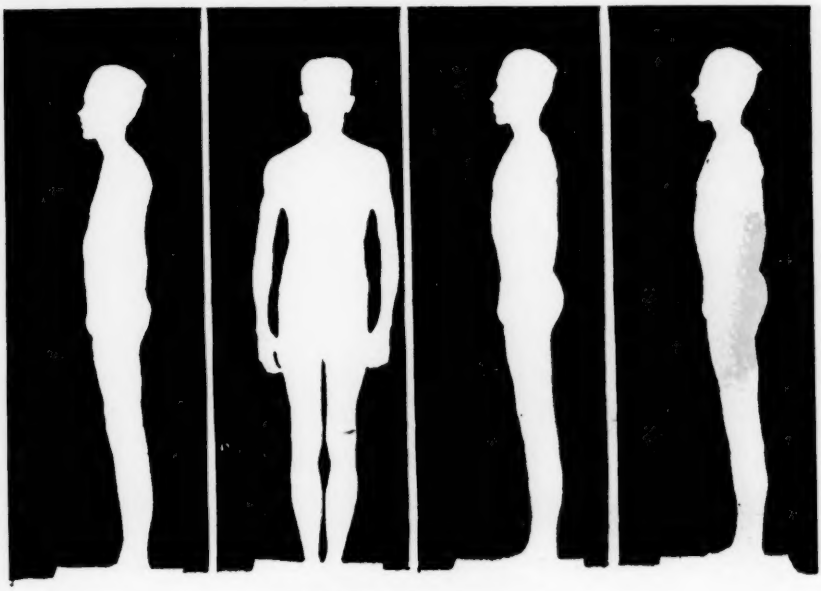
The new and the old type silhouettograph as well as a photostat of the new type are illustrated herewith. The advantages of the new type include the following:

1. The difference in height of the shoulder blades is clearly shown.
2. The direction of the spine is portrayed without special marking.
3. Muscular development is easily seen.
4. A check on the pronation of the feet is made possible.
5. Negatives which will respond nicely to photostatic reproduction and enlargement are available in case there is need for further and more detailed study of the individual.

6. This new method makes it possible to place markings on the body at special places with red grease paint crayons for the purpose of securing better check on alignments, etc.

7. The writer plans to make a further check on the strength of the arches by markings on the foot to indicate the so-called "pedal tripod."

With these possibilities the new shadow-silhouettograph should eventually contribute a wealth of accurate data to check not only the posture



OLD-TYPE SILHOUETTOGRAPH

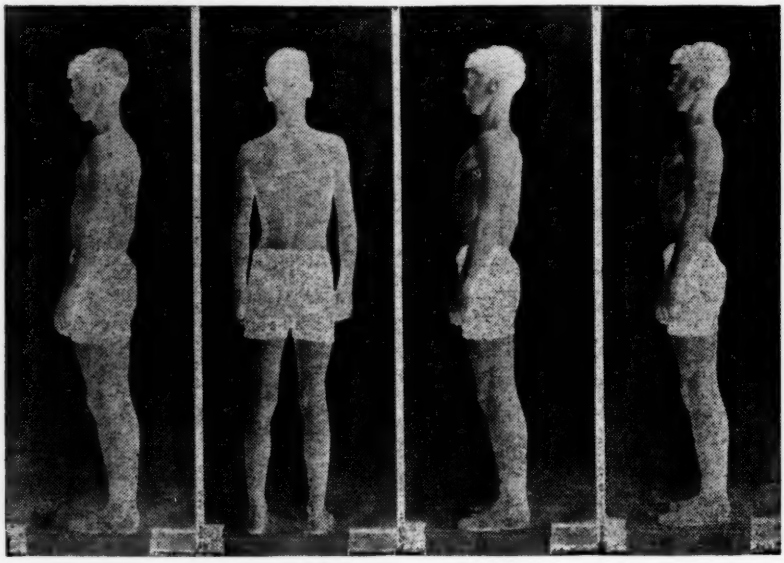
of the individual, but also the muscular development, the body mechanics and even the foot mechanics. The latter alone may be a significant contribution to physical educators who have sought some device to record significant data relating to foot strength.

PLACING OF LIGHTS, ETC.

1. The battery of lights responsible for the more detailed picture is divided into two parts, one on each side of the subject. These lights are fastened on standards which are hooded carefully by screens and adhesive tape over cracks so that light will not be admitted into the camera. Three 200-watt lamps are evenly spaced in a vertical line on each upright standard. Standards are painted white so that as little light as possible will be absorbed by them; and practically all of it thrown upon the subject. They are also raised sufficiently high off the floor to illuminate the subject from head to feet.

2. The old method required a 1000-watt lamp in back of the screen. To this we have added a 500-watt lamp and used it to throw more light down to the region of the ankles and arches. The 1000-watt lamp and

SHADOW SILHOUETTOGRAPH



SHADOW SILHOUETTOGRAPH

500-watt lamp are added to the six 200-watt lamps used on the standards in front of the screen. These require an extra-heavy fuse unless the load is divided between two power lines.

3. The camera is placed ten feet in front of the screen. The subject stands directly in front of the screen. The standards of lights are placed three feet in front of the subject and a little to each side so as not to obstruct the view of the subject from the camera.

4. The material used in the new type silhouettograph is exactly the same as used in the original, namely, 5 x 7 inch photographic printing paper.

5. The time required to take and develop pictures is also the same as for the old-type silhouettograph.

6. We have taken about a thousand pictures with this new method. These pictures are uniform throughout.

ATTITUDES OF PARENTS AND OTHERS

The subject's parents are very much impressed with any type of posture study, but are especially pleased with this method, as it so nearly approximates the photograph and thus makes it possible for the instructor to speak to parents with positive assurance concerning body mechanics. Administrators and trustees are also much pleased with the method. One of our trustees recently remarked, concerning the new type silhouettograph, that *"its value was evidenced by the pleasing display of good carriage exemplified by the boys in the senior class at graduation time."*

This new-type picture, while not quite as clear as a photograph, is considerably cheaper; and the time element required in finishing pictures is also worthy of comment as there is but one operation necessary. In other words, there is no film or plate used, which eliminates the time and expense required in preparing these for printing. As mentioned before, enlarged photostats can be made in case more detailed pictures are wanted.

Methods of Procedure in the City

Comprehensive School Health and Physical Education Surveys*

By John M. Harmon

THIS dissertation is a report of research in setting up check lists or score cards to be used in surveying the efficiency of a high school department of student health, physical education, and athletics. These score cards should be most useful in frequent self-surveys. In application they resemble the widely used Strayer and Engelhardt school building score cards.

The writer has reviewed most of the school survey reports and learned that methods of procedure in the school health and physical education survey have been very subjective. There has been no indication of a trend towards improved methods in such surveys.

The writer secured the cooperation of prominent leaders in the field as follows: women supervisors and administrators of physical education, thirty-six; men supervisors and administrators of physical education, seventy-three; school health administrators, twenty-seven; and athletic directors, fifty-two. The geographical location of these leaders, as indicated by spot maps in the report, indicates that every section of the United States is well represented.

The writer prepared an outline for the score card and sent it to these leaders who were requested to evaluate every item by the distribution of an arbitrary number of 2000 points. After assembling these data the median score was determined for every item in the outline, this being the most defensible method of determining group judgment.

The outline forwarded to leaders included, as page one, a request for the leader to indicate the relative potential value of school health service, physical education, and inter-school athletics in the elementary school and likewise in the junior and senior high schools. This served to orientate the leaders to the material at hand and it also gave some very interesting data in terms of median percentages. These results are here outlined in table form.

From reports of experts a complete score card to survey school health and physical education programs was made up. One part of this score card is reproduced below.[1]

In interpreting the score cards, note that column one is added and

* Abstracted from the author's Ed. D. dissertation at Indiana University, 1932.

[1] Complete copies of this score card, including fifteen sheets, may be obtained for 25 cents each postpaid by addressing the author at Boston University. (Ed.)

TABLE I

THE RELATIVE POTENTIAL VALUE OF THREE PHASES OF THE SCHOOL PROGRAM AS INDICATED BY FOUR DIFFERENT GROUPS OF SCHOOL ADMINISTRATORS AND SUPERVISORS*

	Elementary school				Junior High school				High school			
	Median				Median				Median			
Phases of the program	Athletics	Health	Boys Phys. Ed.	Girls Phys. Ed.	Athletics	Health	Boys Phys. Ed.	Girls Phys. Ed.	Athletics	Health	Boys Phys. Ed.	Girls Phys. Ed.
School health service	50	60	45	50	35	50	40	40	25	50	30	35
Physical education	40	40	50	50	45	40	50	50	40	35	45	45
Interschool athletics	10	0	5	0	20	10	10	10	35	15	25	20

* Table I should be interpreted as follows: In column one of the median scores, "athletics" refers to the scores as determined by the athletic administrators. In column two "health" refers to the scores as determined by the school health administrators. In column three "boys, P.Ed." refers to the scores as determined by the men supervisors and administrators of physical education. In column four "girls, P.Ed." refers to the scores as determined by the women supervisors and administrators of physical education.

carried forward to column two; likewise, column two is added and carried forward to column three, and this column is added and carried forward to the final column. The score opposite every item in the outline is a maximum score to be credited for meeting the standards indicated in full. In using the score card, the evaluation for every item would range from zero to this maximum score indicated.

A SCORE CARD FOR EVALUATING HIGH SCHOOL ATHLETIC PROGRAMS FOR BOYS

	1	2	3	4
I. The Daily Practice.....				650
A. Average daily, weekly time that should be given to practice.....			300	
1. Football		90		
a. Monday practice—75 minutes.....	12			
b. Tuesday practice—120 minutes.....	18			
c. Wednesday practice—120 minutes.....	25			
d. Thursday practice—120 minutes.....	20			
e. Friday practice—60 minutes.....	15			
2. Basketball		80		
a. Monday practice—60 minutes.....	14			
b. Tuesday practice—90 minutes.....	15			
c. Wednesday practice—105 minutes.....	20			
d. Thursday practice—90 minutes.....	16			
e. Friday practice—40 minutes.....	15			

	1	2	3	4
3. Baseball		70		
a. Monday practice—90 minutes	13			
b. Tuesday practice—120 minutes	14			
c. Wednesday practice—120 minutes	20			
d. Thursday practice—105 minutes	13			
e. Friday practice—60 minutes	10			
4. Track and Field		60		
a. Monday practice—60 minutes	10			
b. Tuesday practice—90 minutes	15			
c. Wednesday practice—90 minutes	15			
d. Thursday practice—60 minutes	12			
e. Friday practice—30 minutes	8			
B. Average daily, weekly division of practice			350	
1. Football		150		
a. Fundamentals—M-38, Tu-54, W-36, Th-42, F-15*	60			
b. Scrimmage—M-00, Tu-24, W-48, Th-30, F-00	30			
c. Signals—M-19, Tu-30, W-24, Th-36, F-30	35			
d. Lecture—M-19, Tu-10, W-12, Th-12, F-15	25			
2. Basketball		100		
a. Fundamentals—M-30, Tu-45, W-42, Th-36, F-18	40			
b. Scrimmage—M-6, Tu-23, W-42, Th-18, F-00	30			
c. Signals—M-9, Tu-14, W-11, Th-18, F-10	15			
d. Lecture—M-15, Tu-9, W-11, Th-9, F-12	15			
3. Baseball		100		
a. Fundamentals—M-54, Tu-48, W-42, Th-42, F-33	50			
b. Practice game—M-00, Tu-48, W-60, Th-42, F-00	30			
c. Signals—M-14, Tu-12, W-12, Th-11, F-12	10			
d. Lecture—M-23, Tu-12, W-6, Th-11, F-15	10			
II. The Game				400
A. For Winning all Games			60	
1. For winning 90% of all games		60		
2. For winning 80% of all games		60		
3. For winning 70% of all games		60		
4. For winning 60% of all games		55		
5. For winning 50% of all games		50		
6. For winning 40% of all games		45		
7. For winning 30% of all games		40		
8. For winning 20% of all games		35		
9. For winning 10% of all games		25		
B. Morale of Team			105	
1. All of the squad are enthusiastic in supporting the school, the coach, the other faculty members, and team-mates		43		
2. The teams go into the featured games keyed to a high pitch, and do not let down unexpectedly for intervening games		10		
3. The teams go into all games in a spirit of recreation, but seem to give their very best ability		27		

*M-Monday, Tu-Tuesday, W-Wednesday, Th-Thursday, F-Friday. The numbers following the days of the week refer to minutes of practice.

	2	3	4
4. The team members are exceedingly enthusiastic in victory	3		
5. The team members, including the captain, always accept the judgment of officials in the game	22		
C. Coach's methods of teaching the game		110	
1. When criticism is necessary, it is constructive in nature	40		
2. Demonstration and explanation, execution by player or team, correction by coach	25		
3. The dressing room conference just before games and between halves is used exclusively to teach in a quiet way	25		
4. A combination of methods 1 and 3, which leaves out the word exclusively in 3	20		
D. Attitude of the coach during the game		65	
1. The coach makes all substitutions	20		
2. The coach supports the officials in all decisions during the game	20		
3. The captain may ask for substitutions	5		
4. The coach remains completely obscure during the game, except when the health of his players seems to demand his attention, or other duties call him	10		
5. During the game the coach's time is given to quiet teaching of the game being demonstrated, with the substitutes as his class	10		
E. Medical attention and service (A physician should be at every game ready to treat injuries)		60	
III. Personal contact of coach with players and community			400
A. Individual coaching conferences with every team member during the season (f.b.5, basket b. 5, base b. 4, and track 4)		175	
B. The coach makes many social and civic contacts in the community		100	
C. The coach makes many social contacts with his players		50	
D. The coach is very active in extra-curricular activities, other than athletics		75	
IV. Business Management of Athletics			250
A. The coach keeps an individual accumulative record of each player, which includes his performance record and other vital data		50	
B. The salary of the coach is paid in full from the same source as that of other teachers		50	
C. Games are scheduled by the director of athletics		30	
D. Athletic moneys are handled and controlled by the faculty athletic manager		40	
E. Athletic equipment is purchased by the director of athletics		25	
F. Game officials are hired by the director of athletics	25		
G. Athletic finances are budgeted a year in advance		30	
V. Sanitation of, and Mental Hygiene in the Dressing Room			300
A. Dressing rooms are cleaned perfectly after every day's use		65	
B. The janitor is a full time employee, and not hired by the hour		50	
C. The boys have a sense of responsibility for the equipment, which they do not try to avoid		60	
D. Stealing of the other fellow's equipment is not a problem		40	
E. There is a spirit of cooperation in the use of equipment and facilities		55	
F. Profanity is seldom heard in the dressing room		30	

CONCLUSIONS AND RECOMMENDATIONS FROM ANALYSES OF REPORTS

1. The topic of school health and physical education has been neglected in the school survey.

2. Most surveys that have included physical education and health have resorted to a subjective review of the program as the major method of procedure.

3. More than one-fourth of the city school surveys have omitted entirely school health and physical education.

4. The chief recent development in methods of surveying school health and physical education programs is the use of health knowledge tests.

5. Some of the most valuable methods of procedure have been omitted during the last ten or more years.

6. There is a need for standard procedure in the city school health and physical education survey.

7. School health programs have been given more attention than physical education in city school surveys.

8. There has not been a trend towards improvement in methods used in city school health and physical education surveys during the last ten years.

9. City school health and physical education surveys were just as comprehensive previous to 1918 as they have been since that time.

10. Most of the methods used in city school health and physical education surveys have been very subjective.

11. Many items have been overlooked in the school health and physical education survey.

12. The athletic administrators, the school health administrators, and the physical education administrators consider their own program of greater potential value than it is judged to possess by either of the remaining two groups.

13. Interschool athletics should not be included in the elementary school program.

14. The interschool athletic program in the junior high school should be a very limited program, amounting at the most to only one-sixth part of the physical education program.

15. In the high school the interscholastic athletic program should be about one-third of the physical education program.

16. Upon the basis of the judgment of the juries of experts cooperating in this study, a school corporation would be justified in dividing its budget for the school health and physical education program, in the twelve grades, upon the following basis: 12 per cent to interschool athletic programs, 48 per cent to the remainder of the physical education program, and 40 per cent to the school health program.

17. A group of fifty-eight leading school athletic administrators have

indicated that they believe that the winning of games is of minor importance in comparison with many other results in the athletic program.

18. In measuring the efficiency of a high school athletic department, the proper procedure in the daily practice of the major sports is of more importance than the way in which the game is conducted, and the winning or losing of games.

19. The personal contact of the coach with the players and the community is of more importance than the winning or losing of games.

20. The sanitation of and mental hygiene in the dressing-room is of more importance than the winning of games.

21. The proper business management of athletics is of more importance than the winning of games.

22. The length of the daily football practice is of more importance in high school programs than the winning of games.

23. The time allotment, or limiting the daily basketball practice, is of more importance than the number of games won.

24. The time allotment to baseball practice is of more importance than the number of games won.

25. The proper division of the daily practice time in football to fundamentals, scrimmage, signal practice, and lecture is of more importance than the percentage of games won.

26. The proper division of the daily practice time in basketball to fundamentals, scrimmage, signal practice, and lecture is of more importance than the percentage of games won.

27. The proper division of the daily practice time in baseball to fundamentals, practice game, signals, and lecture is of more importance than the percentage of games won.

28. The moral conduct of the team is of more importance than the number of games won.

29. The coach's methods of teaching the game are of more importance than the percentage of games won.

30. The attitude of the coach during the game is of more importance than the percentage of games won.

31. It is of more importance that the coach have four or five individual office conferences with every member of his squad during the season than that they win games.

32. It is of more importance that the coach make many social and civic contacts in the community than that his teams win games.

34. It is of more importance that the dressing rooms be cleaned perfectly after every day's use than that the team win games.

35. In the school health program, it is of more importance that a good health education program be a part of the curriculum in every grade than to maintain a good follow-up program in health service.

36. The health education program is of more importance than the discovery and correction of physical defects.

37. Both the discovery of and correction of the physical defects of pupils and the follow-up program are more important than the type of organization in the department, the control of communicable disease among pupils, or the supervision of the health of teachers. This conclusion is probably true only when perfection of the ideal is being compared with the average program.

38. It is of more importance that an ideal staff be organized for pupil health service than that the health of teachers be supervised.

39. It is of more importance that an excellent program in the control of communicable disease be maintained than that the health of teachers be supervised.

40. It is of more importance that special classes for the defective be maintained where needed than that a program of morning inspection for all pupils be carried out.

41. It is of more importance that health education have a place in the curriculum for every grade than that a program of daily morning inspection be carried out.

42. It is of more importance that parents be sent a written report of the physical defects of pupils, and advised relative to the best procedure, than that health education have a place in the curriculum for every grade.

43. The placing of health education in the curriculum of every grade is of more importance to the pupil than the immunization of all pupils against diphtheria, smallpox, typhoid fever, and scarlet fever.

44. The factor of regular visits to the homes by the school nurses is of more potential value than the immunization of all pupils or the health education class in the curriculum.

45. The instructional staff, their training, and other qualifications are more vital in a good physical education program than any other consideration in the program.

46. The facilities for physical education, the program organization, and the program of activities are of equal importance to good results.

47. The professional assistance to teachers is of more importance than any single item other than those items mentioned in conclusion numbers 45 and 46.

48. The kind of training the teachers of physical education have had is of more importance than the extent of their training.

49. The physical fitness of the physical education teachers of boys is of equal importance to the extent of professional training they have had.

50. Training in the technique of the many games and other activities is of more importance than any other type of training.

51. One year of professional training in addition to a master's degree in physical education is indicated as the maximum standard of training for men teachers of physical education.

52. The recency of training of teachers is very important even in comparison with the kind and extent of training.

53. The personality and character of instructors is of more importance than the extent of training.

54. The kind of training and the personality and character of instructors is of equal importance.

55. Their efficiency in teaching is of more importance than the extent of training that teachers may have had.

56. Ample play space is of more importance than any other provision in facilities for physical education.

57. Outdoor facilities are of more importance in physical education for high school boys than are indoor facilities.

58. The most important item among the indoor facilities is the playing floor.

59. The most important single item among the outdoor facilities for boys is the baseball diamond.

60. The most important item of equipment in the gymnasium for boys is mats.

61. It is of equal importance that all pupils be enrolled in physical education classes and that they be examined annually for physical defects.

62. A class of forty pupils is accepted as the standard-size class in physical education.

63. In corrective physical education work the classes should have twenty or fewer pupils.

64. Sixty minutes daily for high school boys is accepted as the best standard in time allotment for physical education.

65. A large variety of activities in both the physical education instructional period and in the intramural program is one of the most important responsibilities of the physical education teacher and administrator.

66. Efficient supervision of instruction is worth as much to a physical education program as excellent library service in providing ample books and professional magazines.

67. In the girls' physical education program, the indoor facilities are more important than the outdoor facilities.

68. A varied program of activities is just as important in a physical education program for girls as in a program for boys.

69. A college degree in physical education is accepted as the maximum need for training of teachers in physical education programs for high school girls.

70. Basketball, handball, tennis, volleyball, etc., courts are more important outdoor facilities than any other type of facilities for physical education programs for girls.

71. Interscholastic athletics for girls should not be promoted.

72. Interschool athletics should not be a part of the elementary school program.

73. All elementary school teachers should be trained in health and physical education.

74. Special teachers of physical education in the elementary school should receive at least two years of special training in health and physical education.

75. Time allotment in physical education in elementary schools should be at least thirty minutes daily in addition to the free play periods before school, at recess periods, and after school.

76. Most important in facilities for the elementary school physical education program is ample play space. A good teacher with ample time allotment provides other essentials to a good elementary school physical education program.

77. Most important in activities for the elementary school physical education program is that 100 per cent of the pupils take part in a large-muscle activity program daily.

The Backboard Test of Tennis Ability

By Joanna Thayer Dyer

THE BACKBOARD Test has been designed to measure ability in tennis for classification purposes. It consists in rallying a tennis ball against a backboard, trying to score as many hits as possible in the time limit of 30 seconds. Accuracy and speed, the two prime requisites of tennis skill, seem to be basic, in about equal degree, to success in the test. It is simple in administration, equipment, and scoring. A group of about 30 players may be tested and scored in an ordinary 30-minute period. Both validity and reliability correlation coefficients of .90 or above have been found for this test.

The Backboard Test was constructed, and the first experiment made, with a group of 13 graduate women students at Teachers College, Columbia University in the Spring of 1932. During the Spring of 1934 the most complete and comprehensive experiment was carried out at the North Texas State Teachers College involving 39 cases. In between, several other experiments were made involving a total of 736 cases in all.

ADMINISTRATION OF THE BACKBOARD TEST

A. **Equipment.**—1. Backboard or wall, approximately ten feet in height, and allowing about fifteen feet in width per person taking the test at one time. Two players taking the test at once has been found to be a very satisfactory arrangement. This allows for adequate supervision by the administrator.

2. On this wall a plainly visible line three inches in width, to represent the net should be drawn so that the top is three feet from the ground.

3. A starting line, twenty feet from the base of the wall, should be drawn on the floor.

4. Stop watch with second hand.

5. Two balls and a racquet per player. It is desirable that the balls be in good condition, although it is not essential that they be exactly new. The racquet should be without flaws.

6. One pencil per group of four players.

7. Score card per player. (See sample below.)

B. **Organization.**—Divide the group to be tested into units of four players each, and number them from one to four. Provide each player with a score card on which she writes her name. The following description of the test is then read to the group.

"The Backboard Test consists in rallying a tennis ball against the wall. The object of the test is to cause the ball to strike the wall on or above the net line as many times as you can in 30 seconds. (Pause) When I say 'Go!' start the test immediately by dropping the ball and putting it in play against the wall. Continue to play it to the wall until I say, 'Stop!' at the end of thirty seconds. There is no limit to the number of times the ball may bounce before you hit it. You may use any stroke or combination of strokes. Each ball striking the wall on or above the net line, before the word 'Stop,' counts as a hit and scores one point. You may use any number of balls. If for any reason you lose control of the ball in play, do not try to retrieve it, but

take another ball and put it in play as at the start. Each extra ball used, *after* the first, on each trial, deducts one point from the total score for that trial. You will each be given three trials. The final score on the test is the sum of the total scores for the three trials. All three trials must be completed in one testing period."

Name .....

Trial	Hits	Balls Used	Score Hits—Balls
1			
2			
3			

Final Score.....

Answer questions and demonstrate if necessary:

1. The starting position and method.
2. What is meant by rallying.
3. What is meant by a ball out of control, showing how the saving of time by taking another ball, instead of trying to recover, equalizes the deduction of one point.

The next step is to read the following paragraph, making certain that each player understands the test procedure and her duties.

"In each group:

"*No. 1* takes the test. At the signal, '*Ready?*,' she steps up to the starting line with her racquet and two balls prepared to start the test at the word 'Go.'

"*No. 2* counts the number of balls which strike the wall on or above the net line, *before* the word 'Stop,' and enters them on the score card in the column headed 'Hits' opposite the appropriate trial number. A ball striking coincident with the word 'Stop' does not count.

"*No. 3* counts the number of balls used, *after the first*, and records the number in the column headed 'Balls Used' opposite the appropriate trial number.

"*No. 4* collects the balls of her group, stands in a convenient place near to, but not interfering with, *No. 1*, ready to supply her with more balls.

"Each person takes the Test in rotation. After *No. 1* has had her trial she assumes the duties of *No. 2* while the latter takes the Test; *No. 3* and *No. 4* remain the same. While *No. 3* takes the Test, *No. 4* scores hits, *No. 1* and *No. 2* assume the duties of *No. 3* and *No. 4* respectively. When *No. 4* takes the Test, *No. 3* scores hits, and *No. 1* and *No. 2* remain the same. After each person in the entire group being tested has had one trial, the Test is repeated in the same order until everyone has had three trials in all."

The foregoing organization consumes about ten minutes. Great care should be exercised in these preliminaries to make certain that the test procedure is clearly understood. The testing will then take place smoothly and accurately.

The Examiner then assumes a position to the rear of the players with the stop watch, and begins testing with all the *No. 1*'s who are to take the Test at one time, usually two in number. *Nos. 2, 3,* and *4* of these two groups will follow, and then the *No. 1* of the next two groups will follow, and so on until all have had one trial,

after which the Test is repeated twice in the same order. In case the group does not divide exactly into groups of four, add a fifth player to a group.

DISCUSSION OF TEST ELEMENTS

1. The backboard was chosen as the medium for the Test because:

a) It represents a constant factor, and therefore any score made would be the result of the player's ability uninfluenced by the relative ability of varying opponents.

b) The Test can be scored objectively.

c) The Test can be administered to groups. The number of players is limited only by the breadth of the wall.

d) Accuracy and speed are probably of the same relative importance in backboard rallying against time, as they are in playing tennis. The objection has been raised that one may practice the Test, and so make a better score on a retest, without increasing her playing ability. The answer is that many tennis instructors and high ranking players use backboard rallying as a means of increasing court efficiency. If their theory is true, then a person practicing against a wall, even for the sole purpose of increasing her Test score would at the same time improve her playing ability.

2. It was found during the preliminary experiments with the Test that if less than 15 feet of wall space was allowed for each player, they interfered with one another. More than 20 feet is unnecessary because of the time wasted in recovering such wide shots.

3. *The 20-foot line is used as a starting point only.* It was tried at first as a restraining line, but experiments showed that players seldom advanced more than a couple of feet closer to the wall because of the speedy rebound. Players may, of course, stand as much further away from the wall as they wish, but since this is in fact to their disadvantage, they rarely do so.

4. The ball is required to bounce at least once at the start to provide the same method of starting for everyone. *No limit is placed on the number of times the ball may bounce before being struck,* because it would not be of advantage to anyone not to attempt to hit it as soon as possible.

5. *No limit is placed on the number of balls used,* because:

a) If only one ball were allowed, some players would lose control of the ball before the time was up, and could not then be compared to those who are able to continue for the whole time.

b) Deducting one point for each extra ball used, plus the loss of time in restarting, cuts down the score in proportion to the lack of skill demonstrated by the necessity for using more than one ball, while still allowing each person to employ the whole time allotted. Minus scores are possible, due to the fact that a player may use more balls than she makes hits. This feature of the scoring adds strength to the Test since there is no

point at which the poorness of ability cannot receive a numerical rating.

6. Any stroke or combination of strokes is allowed because the same holds true in a game. Also, on the principle of keeping the Test as true to the game situation as possible, no measure of form is included. While form is, of course, important in improving one's game, still, no points are given toward winning a match on the basis of form. It is a means and not an end. In rallying against a backboard, as in playing on the court, the player with good form will be likely to have more control and greater speed than will the player with poor form.

7. It was found to be unnecessary to include the restriction that the ball must bounce once on its return from the wall before being struck, since a continuous volley is almost impossible. Several good players, all of whom made scores on the Test above 40, were asked to try a continuous volley. All of them lost control of the ball, or were forced to allow it to strike the floor in order to keep it in play, after one volley.

8. There is no restriction on the height above the net at which a ball striking the wall still counts as a hit, since:

a) In the game itself a ball may cross the net at any height.

b) During experimentation it was observed that balls seldom go higher than five feet, and almost never over eight feet.

c) A ball striking the wall high above the net consumes more time than does a low one. This is obviously no advantage. Therefore, only the player with little control over the ball will so direct it. The resulting low score is a legitimate indication of poor ability. If the ball should go over the backboard, the player would naturally take another ball and receive the penalty of one point for poor placement.

9. During the first experiment with the Test in 1932 each player was given five trials. Correlation coefficients were calculated between the criterion and the following five combinations of scores:

a) First trial.

b) Best score made on three trials.

c) The sum of the scores on three trials.

d) Best score made on five trials.

e) The sum of the scores on five trials.

It was found that three trials were necessary for the player to do herself justice but that more trials gave no better results. Therefore three trials was accepted as constituting the Test.

10. The time limit for each trial was determined after preliminary experiments with other times ranging from ten seconds to one minute. Twenty-five seconds were finally taken as providing a period sufficiently long to allow of best performance, and yet not so long as to involve the element of fatigue. After the first experiment at Teachers College in 1930, those taking part, all graduate students in physical education, were asked to comment on the time limit. Their opinion was that an increase to 30 seconds would strengthen the Test and still not reach the

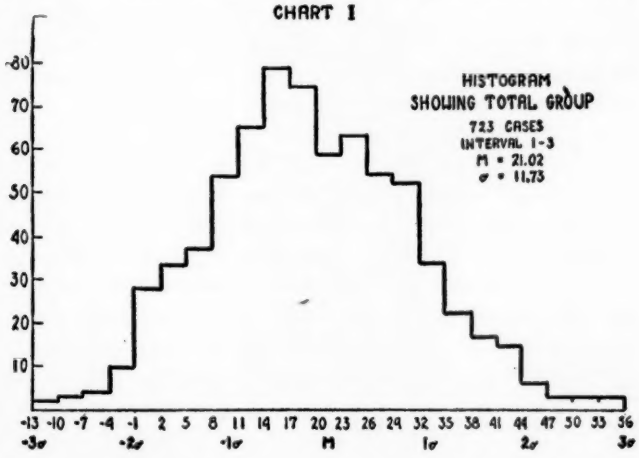
point where fatigue need be considered as a factor affecting the results, and therefore, 30 seconds was adopted as the limit in subsequent experiments.

STATISTICAL DATA AND ANALYSES

A. Total Number of Cases

The study is based on 736 cases, including representative women's tennis groups in 19 colleges. The experiment was begun in February, 1932, and completed in May, 1934. The Test was given as described on page 63 except in the case of the Teachers College group, whose scores are naturally not included. The mean score for the total group is 21.02 for the complete test of three trials for each subject; and the sigma,

CHART I



11.73. The scores range from —11 to +56; and a plotting of the curve shows a normal type of distribution. The base line range is from —3 sigma to +3 sigma. The distribution is shown graphically in Chart I, above.

B. Teachers College Data

At Teachers College, Columbia University, the Test was given to a group of 13 graduate students in the Spring of 1932. The time limit was 25 seconds. The scores range from —4 to +38. Validity was measured by correlation of Test scores with a criterion made from the judgments of three experts as to the playing ability of the subjects, which is considered by Bixler[1] to be the best of the judgments of experts' type. The three scores for each person were averaged, and the group then arranged into a rank order list. A resulting correlation coefficient of .85 was obtained.[2]

[1] H. H. Bixler. *Check List for Educational Research.* Page 49.

[2] Unless otherwise stated the Rank Difference Method of Correlation was used and the values of *r* inferred from Table XX. H. E. Garrett. *Statistics in Psychology and Education,* Page 192.

This group was given five trials on the Test. To obtain a reliability coefficient the sum of trials one and three was correlated with the sum of trials two and four. This grouping of trials was assumed to represent chance halves of the Test, and a Pearson r of .85 was found.

C. Goucher College Data

The second experiment was conducted at Goucher College in the Fall of 1933. The group consisted of 64 cases divided into six sections. The scores ranged from 4 to 55. The criterion used was ranking by one judge, and each section was ranked separately and the group was also ranked as a whole. This criterion is weak, or course, in that it rested upon the judgment of one person only. The r's found are shown in Table I.

TABLE I
CORRELATION COEFFICIENTS
GOUCHER COLLEGE

Group	r
A	.93
B	.96
C	.66
D	.81
E	.95
F	.61
Whole (Pearson r)[3]	.84

D. Mt. Holyoke Data

In the Spring of 1933 the Test was given to 45 students in three groups at Mt. Holyoke College.[4] The scores range from 7 to 40. Three criteria were obtained; semester grade, ranking by one judge, and a rank order list of a group of 15 players, all of whom had participated in a Round Robin Tournament.

The Round Robin Tournament was an experiment itself. It was the outcome of a search for a more objective, and hence a more reliable criterion than the judgment of experts which is necessarily subjective, no matter how carefully done, and to that degree unreliable. The procedure consisted in having each player serve four times to every other person in the group. Whoever won the play scored one point. At the end of the tournament, each player's score was totaled. These total scores formed the basis for the rank order list. As a criterion this technique was weak in that too much depended upon serving skill, and that it was not truly a game situation. Considering the worthiness of the other two criteria, the unreliability of the second has already been noted, and Semester

[3] Clark Hull, "Computation of Pearson r from Ranked Data," *Journal of Applied Psychology*, 6 (1922), 385–390.

[4] The data for Group C, 14 cases, is not included because the correlation coefficient of —.84, Test and Semester Grade, was so far removed from all the other correlation figures as to make it obvious that some mistake in the raw data was present. (Probably the reporters reversed signs of data or method of computing the r, a —.85 r being just as significant as a +.85 r. *Ed.*)

Grade is too much influenced by factors other than actual ability to be considered very desirable. The coefficients obtained are shown in Table II.

TABLE II

CORRELATION COEFFICIENTS
MT. HOLYOKE

Group	*Criterion*	*r*
Whole	Semester Grade	.58
A	Semester Grade	.38
	Round Robin	.65
B	Semester Grade	.70
	Ranking 1 Expert...	.60

E. Eastern Society Data

During the Fall of 1933 the Eastern Society of Directors of Physical Education for Women in Colleges and Universities conducted an experiment in the testing of game skills. The Backboard Test was one of the instruments used. 575 scores were obtained from the data returned by 15 colleges. The scores ranged from —11 to +56. In order to obtain a criterion the instructors giving the Test were asked to rate their students on a 10-point scale. In spite of the fact that a carefully-worded description was a part of the numerical scale, the raw data present many obvious inadequacies. No two instructors seem to have had the same mental picture of the degree of skill for which any one score should stand. Add to this the difficulty of obtaining unified action from about 20 persons who were not located within conference distance, and undependability of this criterion is understandable.

These data yielded 534 cases having a mean score of 18.9, a sigma of 11.25, and a Pearson *r* of .52.

F. North Texas Data

During the second semester of 1934 the Test was given to 39 students at the North Texas State Teachers' College. Of this group 29 were given a retest. The range for the Test was 11 to 53, and for the retest, 14 to 62. Group A, 15 cases, had an interval of about two weeks between testing periods, during which they played tennis about three times a week. Group B, 14 cases, had only a one-day interval. The reliability coefficients obtained from correlating the Test with the retest are: Group A, .90; Group B, .87; Groups A and B combined, .90.

For Group A, two criteria were obtained. Criterion A is a rank order list of the group made by the instructor. Criterion B is based on scores obtained from a Round Robin Tournament.

This was the second attempt to evolve a reliable criterion by this method and is considered by the author to be more valid than any of the others. The technique was changed somewhat from the first time to provide more nearly for a game situation. It was felt that the low *r* obtained with the first technique was in great part due to the fact that too great

a premium was placed on serving ability. As before, each person played every other person in the group. A match consisted of 20 points. A point was won according to the usual tennis rules. The two opponents tossed for service and court. They then played a regulation set, changing serv-

	Ev	Fr	Go	Ho	La	Li	Log	Lor	Mi	Mo	Na	Ne	Pi	Ta	We	Score
Ev		14	9	7	11	11	12	14	17	7	8	4	14	12	15	155
Fr	6		14	2	5	11	6	11	13	7	4	2	11	7	5	104
Go	11	6		8	7	10	4	9	15	4	9	8	7	10	11	119
Ho	13	18	12		11	16	12	15	18	9	10	8	12	13	15	182
La	9	15	13	9		10	9	17	19	9	4	3	13	13	14	157
Li	9	9	10	4	10		9	17	13	8	7	2	12	12	12	134
Log	8	14	16	8	11	11		10	15	10	10	9	10	10	13	155
Lor	6	9	11	5	3	3	10		12	3	4	6	6	6	8	92
Mi	3	7	5	2	1	7	5	8		5	5	4	4	5	2	63
Mo	13	13	16	11	11	12	10	17	15		8	7	11	15	14	173
Na	12	16	11	10	16	13	10	16	15	12		11	15	12	15	184
Ne	16	18	12	12	17	18	11	14	16	13	9		14	13	16	199
Pi	6	9	13	8	7	8	10	14	16	9	5	6		13	11	135
Ta	8	13	10	7	7	8	10	14	15	5	8	7	7		11	130
We	5	15	9	5	6	8	7	12	18	6	5	4	9	9		118

CHART II

Score Sheet—Round Robin Tournament, North Texas State Teachers College—May, 1934, 15 Players—98 Matches.

ice at the end of each game, and changing courts on odd games. The players paid no attention to the scoring of 20 points. The scorer, meanwhile, entered each point on a score sheet as it was won, until the total of 20 points had been played. She then called the match and the players ceased regardless of where they were in the game and set.

It was possible for one opponent to win all 20 points, for them each to win 10 points, or any other combination of the numbers from 0 to 20. Chart II above shows the score sheet used.

Each match took between 10 and 15 minutes. A player occasionally participated in as many as three matches in one period, but the more usual number was two. Therefore, the element of fatigue was negligible. The scorer was a member of the group not playing at the moment. At the end of the Tournament the scores were totaled and the rank order list composed.

The use of the Round Robin technique in obtaining a criterion is based on the hypothesis that if each person in a group plays every other

member of the group, the resulting rank order list is a very fair indication of actual playing ability. It is entirely objective, in contra-distinction to the subjectiveness inherent in even the most "objective" judgment.

The Round Robin technique is, of course, quite a lengthy proceeding. This relatively small group of 15 players involved 98 matches and took about six weeks to complete. It is too cumbersome administratively ever to be of practical value as a test, but it has three unique features which recommend it highly as a criterion. These are:

1. It makes use of the actual game situation. The fact that the two opponents use tennis scoring does two things: first, it does not put more than a normal premium on ability to serve; and second, it has a proper psychological effect, making the players themselves feel that they are really playing a game of tennis. This is so true, in fact, that in no one of the 98 matches did the players know, without asking, how the 20-point score stood.

2. It is about as completely objective as the game itself. A player's score does not depend upon opinion as to her ability.

3. It is a measure of what a person can actually do in the way of tennis skill.

It might have been better to allow 40, 50, or more points but time did not permit the use of more than 20. Players gave as their opinion that, "on the whole, 20 points allowed you to show what you could do." Table III gives the correlation figures.

TABLE III

CORRELATION COEFFICIENTS

NORTH TEXAS

Group A	*Criterion*	*r*
Test	Ranking 1 Expert.....	.84
	Round Robin	.90
Re-test	Ranking 1 Expert.....	.83
	Round Robin	.85

SUMMARY

A. Dispersion

The measures of dispersion, given in Table IV, indicate that a representative group was studied, and that a normal distribution exists in tennis ability as measured by this Test. The most significant feature of these figures is the close similarity between the sigmas. The means also are interestingly close. These facts would seem to indicate that the test

TABLE IV

MEASURES OF DISPERSION

Group	*Mean*	*Sigma*
Whole (T. C. excepted) 723 Cases	21.02	11.73
Eastern Society 534 Cases	18.9	11.15

is sufficiently reliable to produce similar results were the experiments to be repeated.

B. Objectivity

The test is objective because:

1. Opinion as to skill is not involved.
2. Scoring is not dependent upon a judgment of worth.
3. The testing media may be kept constant; i.e., backboard, balls, racquet, time.

It is not objective to the degree that the judgment of the scorer is employed in determining whether or not a ball hits on or above the net line, and to the degree that accuracy in keeping track of Hits and Balls Used and transferring these figures to the score card is involved. These factors, it is believed, are not of sufficient magnitude to render the Test unobjective. The organization, providing as it does for one specific duty per individual over the short period of 30 seconds, tends to make for a high degree of accuracy in the small amount of judgment required.

C. Validity

Table V brings together the correlation data discussed separately on pages 67–70, into a single picture.

The most significant fact brought out in the preceding analysis is the relationship between the validity of the criterion employed and the size of the *r* obtained. In all but three instances the higher *r*'s are based on the more valid criteria, whereas the lower *r*'s are connected with the least acceptable criteria, leading to the definite conclusion that they are spuriously low and not truly indicative of the worth of the Test.

The critical evaluation of the criteria as developed in the section *Statistical Data and Analyses* seems to divide them rather clearly into three groups; *first,* those that are too unreliable to justify the drawing of conclusions; *second,* those that are more sound, but still only good enough to show a tendency; *third,* those that are acceptable and on which definite conclusions may be based.

In the first group belong the Semester Grade and Round Robin criteria as developed by Mt. Holyoke and Eastern Society data. The *r*'s involved in this group are six in number and run from .38 to .70, and from them conclusions may not be drawn.

The second group includes the ranking by one expert as used with the Goucher and North Texas groups. Nine *r*'s were obtained ranging from .61 to .96. Since seven of these are better than .80, the tendency would seem to be strongly in favor of the Test being a valid instrument.

Ranking by three experts as used with the Teachers College group and the second Round Robin technique as perfected at North Texas are the criteria included in the third group. The 3 *r*'s involved range from .85 to .90. Not only are these coefficients the most trustworthy, but they are also satisfactorily high. Therefore, it may be stated that the Back-

board Test is a valid instrument to be used in the classification of groups of individuals on the basis of tennis ability.

D. Reliability

Table VI shows the figures on reliability. The *r*'s obtained in testing for reliability range from .84 to .90. The lowest is from the data of the first experiment when a retest was impossible, and the method of chance

TABLE V

MEASURES OF VALIDITY

Group	*Criterion*	*r*	*P.I.**
T. C.	Ranking		
13 Cases	3 Experts ..	.85	.47
Goucher			
Whole	Ranking		
64 Cases	1 Expert ...	.84	.46
Goucher A	Ranking		
10 Cases	1 Expert ...	.93	.63
Goucher B	Ranking		
11 Cases	1 Expert ...	.96	.72
Goucher C	Ranking		
12 Cases	1 Expert ...	.66	.25
Goucher D	Ranking		
10 Cases	1 Expert ...	.81	.41
Goucher E	Ranking		
10 Cases	1 Expert ...	.95	.69
Goucher F	Ranking		
11 Cases	1 Expert ...	.61	.21
Mt. Holyoke			
Whole	Semester		
30 Cases	Grade	.58	.19
Mt. Holyoke A	Semester		
15 Cases	Grade	.38	.08
	Round Robin	.65	.24
Mt. Holyoke B	Semester		
15 Cases	Grade	.70	.29
	Rating	.60	.20
Eastern Society	Rating		
534 Cases	Instructors ..	.52	.15
N. T. S. T. C.	Round Robin	.90	.56
A	Ranking		
15 Cases	1 Expert ...	.84	.46
N. T. S. T. C.	Round Robin	.85	.47
Retest A	Ranking		
15 Cases	1 Expert ...	.83	.44

* Predictive Indices are included to give the reader a better basis for comparing data. Pearson *r*'s cannot be compared directly, but P.I.'s may be. For example, *r* .85 is not twice as high as *r* .425, but nearly five times as high! But P.I. .47 *is* twice as high as P.I. .235 in indicating true "going-togetherness."

halves employed. Considering the retest groups, the coefficients of reliability range from .87 to .90. Coupled with the fact that the Probable Error in each case is low, ±.05 or less, this represents an acceptably high degree of reliability.

TABLE VI

MEASURES OF RELIABILITY

Test	*Criterion*	*r*	*P.I.*
Trials 1,3	Trials 2,4		
T. C.		.84	.46
N. T. S. T. C. Whole	Retest	.90	.56
N. T. S. T. C. Group A	Retest	.90	.56
N. T. S. T. C. Group B	Retest	.87	.52

CONCLUSIONS

1. The Backboard Tennis Test may be used to measure improvement or achievement by testing a group at the beginning of a period of instruction and practice, and again at the close of the term. It would not be correct, of course, to grade on the basis of increase in Test score alone. We are unable to say up to what point an individual is capable of improving. Also, the known fact that improvement is easier and more rapid at lower levels of ability than at the higher suggests that the beginning player, having more room for increase in skill, is likely to show a larger numerical increase in Test score than will the advanced player.

2. The simplicity of the Backboard Tennis Test, and the fact that it can be administered to a normal size class in one period, also recommend it as a motivating device. When used in this way it may prove a valuable method of stimulating the individual to greater effort. It is interesting to note here that 85 per cent of the North Texas group, after a two weeks interval of instruction and practice, showed substantial increases in scores on retests.

3. The most important use of the Test is as an instrument for the classification of groups whose degree of present ability in tennis is unknown. It is suggested that those scoring below 10 points be classified as Beginners. Those scoring between 11 and 32 might be grouped as Intermediates. Above a score of 32 is suggested as the range for an Advanced classification. No doubt it will be found necessary to exercise judgment in the sectioning of borderline cases, possibly over a 5-point range above and below the indicated points of demarcation.

4. Further experimentation is necessary to establish norms. A study is at present under way with a group of persons who have never played tennis to investigate the lower range possibilities. Similar experiments need to be made with other levels of ability. Contributions of test results and other data by anyone interested in this future experiment would be most welcome.

Part II

Programs for the Conservation of Physical Powers

"It is better for a man to maintain himself in good health than to load himself with learning. Indeed, I would rank good health very high in the major satisfactions of life. I would almost say: "Be healthy and you will be happy." The common phrase, "enjoy good health," is a just phrase. When one has good health one enjoys it all the time, and the healthy man needs little else for his satisfaction."

—Arnold Bennett.

Saga: Redirecting Physical Education in a City High School

By Carl G. Chamberlain

I

In 1926 "physical training" was a well-established subject in New York State. Relief-drills, gymnastics, and a few collegiate major sports made up the program. Most men directors were preoccupied with interschool sports. The major events of each year were regional and state championships in basketball and track and field sports. We were conforming to the mode.

But in 1927 a new program of "physical education" was outlined by state officials. This program derived its justification from two sources—educational philosophy and educational psychology. Philosophy provided aims and objectives—health, social efficiency, and culture. Psychology suggested methods—individual differences and individual adjustment thereto; equality between opposing teams; player-control; the reorganization of classes and regrading of materials; and measurements to determine needs, to equalize teams, to discover those most worthy of freedom and to evaluate results.

Representatives of the State Department visited Rochester to discuss these new programs. We talked with them. We argued. They explained; we listened. It seemed we would rebuild the ship together. We would begin with a power plant of sound philosophy. We would chart a course, stick to it, and reach our destination!

In the beginning we were frankly skeptical and challenged at every opportunity all suggestions made covering the new program. Experiments in our own school brought these tentative conclusions:

1. Claims for the benefits to be derived from a redirected physical education program were in every instance substantiated by our experience.
2. Pupils were more interested in the work.
3. Programs could be arranged to meet individual needs.
4. Results could be measured.

In December, 1927, it was the writer's privilege to present to his superiors a synopsis of a proposed redirected health and physical education program for the Charlotte High School, to begin in January, 1928. This proposed plan covered the following points:

1. It would attempt to meet individual needs by segregating pupils into homogeneous groups for physical education, by means of (1) medical examinations and (2) physical fitness tests.

2. Existing classes would be reorganized to meet the new conditions. This would involve some adjustments in the registration procedure.

3. Additional teacher help would be required.

4. Public opinion must be developed. (This was done through the media of letters to parents; talks before Parent-Teacher Associations; and talks at faculty meetings and student assemblies.)

5. Additional equipment would be needed.

The advantages which we hoped to derive from the proposed program were:

1. Graded work for the individual
2. Results which could be measured
3. "Dosage" of physical education time according to pupil needs
4. More emphasis on intramural activities
5. Less emphasis on interschool activities
6. Development of student leadership
7. Improvement of the status of health and physical education as a part of the school curriculum.

II

With the joint approval of Dr. Herbert S. Weet, Superintendent of Schools; Mr. Roy L. Butterfield, Principal of the Charlotte High School; and Mr. Herman J. Norton, Director of Health Education in the Public Schools of Rochester, New York, the redirected program was inaugurated in January 1928.

Registration and Organization.—The first problem to confront us was the matter of registration procedure. How could we work these new classes into the already crowded school schedule? The solution was relatively simple. Tallies were made for physical education, *the same as for all other subjects*, on a bases of four types of physical education work being offered, viz., (1) work for "handicapped pupils," (2) "low average" classes, (3) "high average" classes, and (4) "physically superior" pupils. The number of classes for each type of work was determined in the usual manner, and the registration completed along with the registration for other subjects in the curriculum. Thus, because the "low average" group consisted of but twenty-six pupils, and so was a "unique" in the program, it was scheduled *first*, along with other uniques such as trigonometry and Virgil. If there were three classes to be assigned for any phase of work, they were assigned as "triplets" along with other triple subjects. In this normal manner the registration was completed, and we were ready actually to start working on the very first day of the new semester.

Special Cases of Handicapped Pupils.—The work with pupils whose P.F.I's were low, or whose medical examinations showed that they were handicapped, was naturally of major interest to us because it was a new problem. These low P.F.I.'s indicated conditions that challenged every resource to determine causes and remedy conditions.

The following cases are illustrative:

a) John—Age fourteen years; Physical Fitness Index 67; father deceased; poor financial conditions at home. Conferences with John disclosed that he had been suffering from earache for the past year. Mother anxious to cooperate and readily consented to examination. School physicians reported rapid heart rate, fatigue posture and poor nutrition. Third physician checked up on cardiac condition and also recommended a visit to the eye, ear, nose, and throat clinic. Conference with mother resulted in John's going to family physician for fourth examination. In the meantime he was put in a nutrition group at school.

Health education teacher reported findings of three previous examinations to the family physician. Family physician influenced the mother to permit John to attend eye, ear, nose, and throat clinic. The clinic diagnosed the case as chronic pharyngitis, and began treatment.

At the close of school in June, the condition had cleared up, and the lad had already gained six pounds. A beautiful case of a low P.F.I. indicating a condition which needed attention, and a fine example of meeting individual needs in health and physical education.

b) Henry—Age fourteen years; Physical Fitness Index 31; markedly obese. Referred to school and family physicians for check up. Diagnosis of congenital deficiency and glandular disturbance. Pupil put under treatment at hospital clinic and at close of school year showed definite improvement in his condition.

Another case of a serious health handicap brought to the attention of the teacher through the use of the physical fitness tests.

c) R.A.—Age fifteen years; Physical Fitness Index 60; Medical Examination disclosed generally run down condition, and marked constipation. Through the systematic development of sound health habits and regular exercise the constipation was improved and the Physical Fitness Index raised to 103, a gain of 43 in one semester!

Recreational and Social Development.—Nor did we ignore or neglect the social development or recreative skills and interests of pupils of low or high physical fitness. Classroom teachers and outsiders were appointed to expand already strong intramural and interschool sports programs. Pupil management was extended wherever possible. So-called player control was instituted in the conduct of interschool contests, and many minor adjustments were made to achieve more effectively the social efficiency and cultural objectives of the State program.

Thus, the critic who might be tempted to question the "redirected program" as one-sided, favoring health aim exclusively or chiefly would be grossly in error. We had not made health objectives paramount—we had only placed them *first* in order for administrative purposes.

Results.—In June, 1928, we were able to report the following results from the redirection of the health and physical education program:

1. Ninety-eight per cent of the boys able to participate at all actually participated in some form of organized, after-school recreation.

2. Among the "physically gifted" pupils the group average P.F.I. increased from 119 in January to 130 in June. Their social efficiency and culture had also improved noticeably; though, unfortunately, we had no measuring instruments to determine "how much."

3. In the "high average" group, the group average P.F.I. increased from 98.4 in January to 104.3 in June, with proportionate improvements in social character.

4. In the "low average" group, the average P.F.I. increased from 89.2 in January to 100 in June.

5. In the "handicapped" class, results were most significant:

a) Twenty-six complete stripped medical examinations were made, including Wasserman reaction and urine analysis.

b) Two cases were hospitalized.

c) Each pupil in the group increased both his Strength Index and his Physical Fitness Index.

d) Thirty-one interviews were held with parents.

e) Two cases of flat feet were remedied.

f) Each pupil participated in at léast one leadership project, thus gaining at least some experience in "citizenship."

g) Three pupils had defects remedied during summer vacation.

h) Two pupils, apparently 20 per cent or more overweight, reduced to average weight for height, and five other overweights made progress (of course, their P.F.I.'s increased greatly).

i) Nine apparently underweight pupils attained average weight for height, while four others made perceptible progress (with great increases in P.F.I.).

j) Every pupil in the group learned to wrestle or play handball.

k) Every pupil in the group learned to play tennis and baseball.

l) The group average P.F.I. was increased from 71.5 in January to 87. in June—a gain of 21 per cent*.

6. Pupils throughout the school showed increased interest in the physical education program.

7. Faculty associates were unanimous in expressing approval of, and interest in, the redirected program.

Administrative Opinions.—Dr. Herbert S. Weet, then Superintendent of Schools in Rochester, New York, said:

> "If there is one principle more than another by which we can determine whether a public school system is headed in the right direction, it is found in the extent to which that system is using all its possible resources to think and work in terms of the individual needs and personalities of the children concerned."

Roy L. Butterfield, then Principal of the Charlotte High School,† wrote as follows in June 1928:

> "— The plan appealed to me at once, so I took occasion to read and to listen to expositions on the subject at zone meetings of the State Teachers' Association in Rochester in November, 1927, and to advise with proponents personally. Then,

* Compare this with the gain reported for a corrective group in Quincy, Massachusetts: page 119.

† Mr. Butterfield has since become Principal of the new Benjamin Franklin Junior-Senior High School, one of the largest in the country. Here the author as Director of Physical Education has carried on with an expanded program.

after giving the tests to a limited number of pupils and applying the knowledge thereby gained to what we already knew about these pupils from other viewpoints, I did not hesitate to join in a request and recommendation that this school's gymnasium program for the present semester for boys be organized according to the recommendations given us. In order to carry out such a plan we quite naturally found that procedures would differ from those previously in effect and so some extra effort was required, but this burden was most willingly assumed.

"Although our facilities are distinctly limited and those we have far from ideal, we have experienced almost no difficulty in administration. From my original stand that the plan is desirable, I have come to believe that it is entirely practical in operation and functions much more effectively than health education programs formerly used have done. I would be very unwilling to abolish it, and look forward, if permitted, to extending it to all our pupils, both boys and girls."

Herman J. Norton, Director of Health and Physical Education in the Rochester Public Schools, and a national figure in the field, comments as follows:

"In the Spring of 1927, Dr. Herbert S. Weet, Superintendent of Schools, authorized heads of departments in the Rochester School System to survey all courses of study then being used with the view of recommending revisions . . . to better meet the present day educational needs of school children.

"As Director of Health and Physical Education in the Rochester schools, I had felt for some time that our courses of study should be so organized and administered that they would meet the physical needs of three types of children: namely, those who were physically superior, average, and inferior.

"In an effort to find out whether any school system had developed a testing program in the field of health and physical education which would roughly classify children into these three groups, or if they knew of any school system which had developed a "physical quotient," I wrote to Dr. Thomas D. Wood of Columbia University; Dr. Thomas Storey, of the College of the City of New York; Dr. Henry C. Morrison, University of Chicago; and Dr. James F. Hoosic, Columbia University, and asked them if they knew of any such tests in the field of health and physical education. The answer in each case was "No."

"In the fall of 1927 the then Director of the Health and Physical Education Division of the State Education Department of Albany, New York, asked me to review a manuscript dealing with a testing and measurement program which he was about to have published. After reading through this manuscript, I was convinced that the State Director had thought through and developed an index of the physical fitness which compared very favorably in its field with the Terman Intelligence Quotient used to classify children in the field of mental education.

"We invited the Director to come to Rochester and discuss his program with some of our health and physical education teachers. One of our teachers, Carl G. Chamberlain, Director of Health and Physical Education at Charlotte High School, indicated a desire to give the program a try-out. Mr. Chamberlain's request was approved and the testing program was initiated in the Charlotte High School during the semester beginning January, 1928.

"The results of this try-out indicated that a real administrative contribution to the work in the field of health and physical education had been made. Through the application of this program we were able to classify children and then build health and physical education courses of study to meet individual health needs . . .

". . . In my judgment, the new 'redirected' program makes it possible for all secondary school health and physical education teachers to classify students . . . and to build programs to meet the individual needs of boys and girls . . . I recom-

mend it as a sound administrative program in the field of health and physical education."

Subsequent Developments.—The outstanding results obtained from this first redirected program led to still further adoption during the school year 1928–29. It was hoped that we would be able to extend the program to include girls as well as boys, but lack of a satisfactorily reliable battery of tests for girls precluded the possibility of immediate inauguration of a girls' program on a par with the boys'.

This lack was a challenge that resulted in almost continuous research for three years, finally resulting in a revision of the battery to make it more applicable to both sexes.§

The boys' program was continued during the next year, and is still in operation, although somewhat changed in form from the original pattern. Interest in the work spread slowly but steadily through the state. Opportunities were many to "spread the gospel," and each opportunity was welcomed as a challenge to make physical education really "education through the physical."

With continued experience, it soon became apparent that "progress checks" were necessary in order to measure results as the work proceeded. From this necessity came the use of posture silhouettes, footprints, and various self-testing devices, all of which act not only as progress checks, but as valuable means of pupil motivation.

Girls' tests and norms were finally made available, and the work was extended to include both sexes with equally gratifying results.

Again quoting Herman J. Norton:

"During the school years 1928–29–30, heads of departments together with principals' and teachers' committees revised all courses of study in the Rochester Public Schools. Mr. Chamberlain's successful experiment with the new testing and measurement program convinced us that we should adopt this program and include it in our revised course of study for secondary schools. Consequently, on May 13, 1929, I secured the approval of the Secondary School Principals' Council for the adoption of this program for our Rochester high schools. Since that date, our secondary school heads of health and physical education departments have gradually introduced the program into their schools, so that it is now established in all high schools."

III

Although this narrative has for its *raison d'être* the mere fact that it is a genesis of a new physical education, written for historical purposes,* the writer ventures to gaze into the crystal of the soothsayer to learn what is foretold.

§ "A Revision of the P.F.I. Battery of Physical Fitness Tests," a report, now in preparation, of arm strength tests which are more reliable and easier to administer than push-up and pull-up tests.

* As far as is known to the writer, the experimental program at Charlotte High School was the first completely redirected physical education program in an entire secondary school.

"There is no way of judging the future except by the past"; and so, just as the physical education of the past was the result of the attitudes of those actively engaged in the profession, the future of physical and health education lies with those who have in their keeping the education of boys and girls through a program of activities predominantly physical. The ship has been rebuilt on modern lines; we have the power needed; we have all of the necessities for successfully navigating the sea.

College directors are now becoming interested, and we are facing a "new era" in physical education. Normal schools and colleges are beginning to think about revamping curricula to include tests and measurements and their application to teaching situations. Public schools throughout the nation are beginning to think in terms of the individual. "Physical trainers" are becoming "physical educators"—a change much more significant than the mere change in nomenclature indicates. A new interest in the individual is being born, nurtured, and groomed, and now we find regularly organized classes for physically handicapped pupils in all school health programs worthy of the name.

Will we sail straight and fast to our destination of Health, Happiness, and Good Citizenship with our precious cargo of boys and girls? The present generation of newly-trained sailors-before-the-mast bids fair to sail a straight and true course! It behooves us old-timers to watch the wheel, lest we be out-maneuvered by these younger, more eager helmsmen.

The Lynbrook Physical Education Program

By James J. Carter

THE PROGRAM

A COMPLETE record of "the evolution of the Lynbrook physical education program" would make a helpful document to those embarking on reorganization, for it would illustrate many problems and suggest solutions which others must discover at great cost to themselves. All we can do here is to outline the present program.

1. **Classifications to Meet Individual Health Needs.**—In the spring of every year, all high school pupils at Lynbrook are given Physical Fitness Index tests and classified for the following fall's activities. Eighth graders are tested in their own buildings, and those in grades nine to twelve in the high school gymnasium. Medical examinations are given previously to P.F.I. tests, and where P.F.I. records show the need, special follow-up medical examinations are made.

Distributions are then made. All pupils with P.F.I.'s below a figure *determined by the average for the entire group and the facilities available,* and all with other special defects, as in posture, weak feet, heart defects, malnutrition, and others selected by the school physician, are then assigned to corrective classes for the following fall. All with P.F.I.'s between 86 and 106 in 1934-35 (the figures are different for each year) are required to elect some intramural or interschool sport three periods weekly. Those with P.F.I.'s above 106 (in 1934–35) are not *required* to participate in any activity. In 1932–33–34 the figures in Table I prevailed:

TABLE I

Classification of Pupils, 1932–35

Years	Total Pupils	A	B	C
1932.....	737	176	284	277
1933.....	754	211	340	203
1934*.....	685	227	300	158**

* Smaller enrollment of students because none were accepted from neighboring school district as had been custom for many years.

** "C" group becomes smaller so that more individual work may be done. "Doctor's certificate cases" are now placed in this group which makes the class enrollment larger; but these are not included in the chart because P.F.I. tests are contra-indicated.

It is a distinctive feature of the Lynbrook program that dividing points for groups A, B, and C are not determined in advance of testing. Rather is the plan to include in group C a certain *number* of pupils. Improved facilities to accommodate more pupils and higher school averages from year to year have resulted in the inclusion, in the C group, in 1935, of all pupils with P.F.I.'s below eighty-six for boys and eighty-two for girls, including one third of the entire student body.[1]

2. **Adaptations of Programs for Low P.F.I. Pupils.**—Obviously, the chief need of low P.F.I. pupils is for guidance in the improvement of physical vitality or the correction of specific defects or both. However, corrective procedures are not exclusively or even chiefly specific exercises. Pupils in any C class are divided into two groups. During any particular day one group engages in corrective activities in the special corrective room or rests in a cot room, while the other group goes to the gymnasium for a varied program of marching, games, and sports. The next day the groups exchange facilities, programs, and instructors.

This plan requires two physical directors but, through pupil leadership *of volunteers from group A or B who receive special academic credit,* the burden on teachers is not great.

The school physician supervises all corrective procedures; and the school nurse cooperates by visiting homes. The cooperation between these three official services is of necessity very close and highly important.

Unlike the general concept of "corrective activities," at Lynbrook "correction" means guidance. Thus, contrary and anti-social pupils are readjusted through personal conferences and the assignment of duties as privileges. Overweight pupils are corrected more by games and cooperation between parents and nurse in rearranging diets than by physical activities in corrective classes.

3. **Scheduling Pupils in Group C.**—The problem of conflicts is easily solved by repeating the corrective class four times each day. Two classes are for boys and two for girls. Since individual programs are prepared during the summer the principal can arrange most schedules satisfactorily. Any remaining conflicts are arranged with pupils or parents. The physical education assignments are made first. The 1934–35 schedule and class roster is reported below. Pupils assigned to class C classes attend daily—four days are devoted to physical activity, the fifth to hygiene instruction.

With increased staff and facilities all students would be scheduled according to their most urgent needs. With limited facilities it seems proper for us to recognize first the individual needs of our low P.F.I. group.

4. **Freshman Programs.**—In order to give freshmen (except class

[1] Some directors prefer to set arbitrary limits and then have as an *ideal* goal the reduction to *nil* of pupils in lowest group. (Ed.)

C pupils, who receive general as well as corrective training in corrective classes) the basic training necessary to participate, manage, captain, and officiate in sports and to acquire fundamental experience and skills, they attend physical education programs three periods weekly, two of which include gymnastics and sports; the third is a social dancing class for both sexes. A carefully planned program of teaching guides physical educators, who are able to crowd into one year's formal instruction sufficient knowledge and experience to insure the success of the intramural and interschool sports programs in the upper years.

FIRST SEMESTER
ROSTER OF "C" CLASSES 1934–35

	Boys				Girls				
Class Time	Fresh.	Soph.	Junior	Senior	Fresh.	Soph.	Junior	Senior	Grand Total
9:10 9:50	7	4	13	3					
9:50 10:30					5	9	6	13	
10:30 11:10	3	4	14	10					
11:10 11:40					7	3	13	7	
2:10 2:50	13	2	5	10					
2:50 3:30					3	12	6	6	
Totals	23	10	32	23	15	24	25	26	178
	Boys' Total 88				Girls' Total 90				

5. **Intermediate or B-group Programs.**—The B or intermediate group pupils elect intramural, interschool, or individual activities, which they attend three days weekly, each pupil arranging his days with a class leader or the director. These pupils may change their elections almost at will. Activities are under the supervision of the director, academic teachers, or pupil leaders. Attendance is taken by pupils.

Intramural or individual activities promoted in 1933–34 with the numbers of participants are listed in Table II.

6. **Freedom for Superior-Fitness Pupils.**—A procedure many directors disapprove but which functions satisfactorily at Lynbrook is the excusing of high P.F.I. pupils in grades ten, eleven, and twelve from any compulsion to participate in physical activity. The theory is that (*a*) these pupils already have high physical fitness; they do not

need the requirement; (b) freeing them will reveal, in subsequent tests, whether they have persisting habits—no other method will do this; (*c*) more lasting habits will be inculcated when pupils choose their own time for, as well as type of, activities; (*d*) often the high P.F.I. pupils need redirection into academic activities; and (*e*) if these pupils need redirection for moral or social development, the need will be revealed better under conditions of freedom than compulsion.

TABLE II

INTRAMURAL ACTIVITIES AND NUMBER OF PARTICIPANTS IN EACH FOR 1933–1934

Classification	Activity	Boys	Girls	Total	Facilities Used
Intramural	Football	65		65	School
Intramural	Basketball	90	96	186	School
Club	Horseback	14	28	42	Outside
Club	Polo	10		10	Outside
Club	Bowling	15	10	25	Outside
Club	Fencing	28	22	50	School
Club	Rifle	32		32	Outside
Intramural	Wrestling	25		25	School
Intramural	Hockey (fld.)		50	50	School
Club	Swimming	15	10	25	Outside
Club	Archery	15	15	30	School
Intramural	Baseball	75	50	125	School
Intramural	Tennis	20	50	70	School
Intramural	Golf	20	10	30	Outside
Intramural	Track	40		40	School
Club	Hiking	5	20	25	Outside
Club	Boxing	10		10	Outside
	17 Activities	479	361	840	

Results bear out all the above assumptions. Pupils in A group usually are the most active in sports; they are usually the most social; where they are not the condition is quickly seen. The P.F.I. of A boys increased from 114 in 1933 to 118 in 1934.

7. **Interschool Athletics.**—Lynbrook High School maintains interscholastic teams in the sports reported in Table III.

All of these sports teams are coached by teachers in the high school, who are employed to perform these duties as well as others. During 1933–34, their wins and losses were as reported in Table IV, which shows that the intramural and corrective programs did not detract from the success of interschool sports. Girls' teams play in the afternoons. Games are followed by tea or dancing. "Social contacts" are the chief *raison d'être* for these games.

Student managers keep attendance records, care for equipment, and aid in preparing schedules.

WAYS AND MEANS

The program sketched above is not excessively costly, for the cooperation of a goodly variety of agencies is secured. Some of these are listed here further to illustrate the scope of the program.

1. **Mobilization of Facilities.**—Lack of school facilities for physical education is a major handicap in many communities.

a) **Gymnasia.**—During the school day, the gymnasium is largely used by corrective and other special classes. A corrective room was provided by using a basement classroom—remodeling it and adding equipment. Later another adjoining class-

TABLE III
INTERSCHOOL ATHLETIC TEAMS

Sport	Boys	Girls	Total	Facilities Used
Football	50		50	School
Basketball	30	30	60	School
Baseball	25	18 (soft ball)	43	School
Track	35		35	School
Golf*	10		10	Outside
Tennis*	10	10	20	School
Bowling*	8		8	Outside
Wrestling*	10		10	School
Swimming*	12		12	Outside
Hockey—Ice*	10		10	Outside
	200	58	258	

* Minor sport activities in which there were informal and league matches, but no records were kept of matches won or lost.

TABLE IV
WINS AND LOSSES BOYS AND GIRLS
INTERSCHOOL CONTESTS 1933–34

Sport	Sex	Won	Lost	Total
Football	Boys	3	4	7
Basketball	Boys	8	5	13
Basketball	Girls	6	6	12
Baseball	Boys	10	1	11
Baseball	Girls	2	4	6
Track	Boys	6	2	8
		35	22	57

room was commandeered and transformed into a combination restroom and "quiet exercise room" for malnourished and heart cases.

Three elementary schools have gymnasia which are used after school hours for high school intramural activities, while the high school gymnasium is used for varsity practice and games. The corrective room is used after school hours for wrestling and ping-pong. During the most crowded hours, ping-pong tables are set up in corridors.

b) **Playing Fields.**—The local athletic fields which include a football field and three tennis courts were supplemented by securing permission for pupils to use private tennis courts. The use of a local Tom Thumb golf course was donated for afternoon activities. The ice hockey team uses the Brooklyn Ice Palace for games, meeting New York City high school opponents. For swimming and diving, pupils go to Long Beach, about six miles away, transportation usually being provided by the girls' physical director, mothers, and friends. A local bowling alley was secured for the exclusive use of school children during certain hours, guaranteeing proper social conditions. A hiking club was formed—to use "all outdoors."

c) **Other Facilities.**—Between six hundred and seven hundred horses (!) were made available at special prices for riding clubs. These are at a state park five miles from the school, but transportation is provided and a five-mile ride included for seventy-five cents. The school fencing club meets with an adult fencing club. A church shooting range is used by the rifle team without cost to the school. The bicycle club uses highways and beaches for rides and picnics. The state park is used for archery during the early fall and late spring. During the winter, archery is carried on one night weekly in the high school gymnasium.

2. **Assistants.**—One man and two women serve as full-time assistants for grades and high school. (The total city school enrollment is approximately two thousand four hundred pupils.) An office clerk serves during the school day and after school, assisting with records, correspondence, filing, and the intramural program.

Of part-time assistants the following serve regularly:

1. A German teacher supervises girls' bowling.
2. An English teacher assists with swimming.
3. An art teacher assists with archery.
4. Another English teacher supervises the riding club.
5. A commercial teacher supervises the rifle club.
6. A history teacher supervises boys' bowling.
7. Another history teacher supervises intramural basketball, assists in varsity football, and supervises intramural baseball.
8. A science teacher supervises varsity and intramural track and wrestling.
9. The assistant principal now supervises boys' hockey.

The director supervises all after-school activities in high school rooms.

Teachers usually do not receive extra compensation for these services, which are considered part of regular school duties.

Post-graduate students and even senior students are called upon for considerable assistance—to referee intramural basketball, to handle interscholastic ping-pong (a league which involves nine schools and is conducted without assistance by Lynbrook), to arrange facilities for all intramural and most interschool games, to manage the roller-skating club, etc. A small number of post-graduates is relied upon in the course of a year for these duties. About forty-five seniors also assist.

3. **Finances.**—No general student body organization collects dues to support any phase of the program.

a) A "class night" is conducted annually, which provides practically all the funds for conducting sports, both intramural and interschool. This came about as follows:

About eight years ago a problem arose which seemed worthy of careful consideration. Two boys (brothers) were very much humiliated by the remarks of other students, because they would not join our Athletic Association. Upon investigation we found that financial circumstances in the home prevented them from doing so. As a result, these boys never participated in any of the school functions, athletic or social, though they had potential powers as athletes. When later two other brothers of the same family came to school, they became two of our most outstanding athletes because at this time the Athletic Association had been abolished. Its place had been taken by our

Class Night

Unlike the festivities of "Class Day" during commencement, this is a period of competition which comes to a climax with the awarding of a perpetual trophy usually on the first Friday in December following the Thanksgiving recess. The date and certain regulations are set by the department of physical education, but otherwise Class Night is handled entirely by student committees appointed by the four senior high school class presidents. A scoring system is worked out and points are awarded in the following events:

1. Poster contest.
2. Dramatic skits (written by students).
3. Decorations of gymnasium corners (allotted each class).
4. Sale of tickets.
5. Sale of refreshments.
6. Basketball games (teams from each class, varsity members excluded).
7. Cheers (original cheers and leaders who have not acted in this capacity before).
8. Costumes (in keeping with the scheme used in decorations).

The students of the following departments of the school are called upon in this plan: home-making—costumes; manual arts—frames for decorations; art—posters and painting of mural designs used in decorations; English and dramatic groups write and stage the dramatic skits; commercial department—sale of tickets and refreshments.

Each year we clear as much on this single event as we would if every student paid one dollar to an Athletic Association. Thus, every student is given the same privileges and opportunities as those formerly offered only to members of an Athletic Association. It is unanimously voted the most popular activity of the year.

b) Gate receipts from interschool contests support interschool athletics. The income and expenses from all activities for 1933–34 were approximately as follows:

Gross Income	$2,006.00
Expenses	1,791.00
Balance	$ 215.00

c) The School Department has not provided any sum since 1932 for sports paraphernalia or equipment for players, but pays all salaries of directors, nurses, physicians, and coaches.

d) Pupils pay reduced fees for all special activities such as bowling and horseback riding.

Out of receipts listed above, all interschool and intramural equipment is purchased.

RESULTS

The Lynbrook program is probably not unique in any particular. Rather would the writer stress its balance in organization to attain all proper objectives of physical education, including social, moral, and cultural as well as physical objectives. In one respect, however, Lynbrook may be outstanding: its achievement of proved results in increasing physical fitness. These and other data on results are reported below:

1. **Physical Fitness.**—Since 1928, the average P.F.I. of the entire High School has increased steadily. This growth is particularly gratifying because it represents a real gain of the entire student body in "capacity for physical activity."

Following through a single class, as an example, the pupils of the 1933 graduating class increased each year in P.F.I. as follows: Freshman year, + two P.F.I points; Sophomore year — two P.F.I. points; Junior year + three P.F.I. points; Senior year + four P.F.I. points. The significance of these gains is revealed by the fact that in most high schools where programs are not adapted to individual needs, the P.F.I. drops about 2 per cent a year. Thus, the real average difference for all Lynbrook pupils remaining four years is approximately 15 per cent over that in the average high school.

The gains by academic classes for 1933–34 are given in Table V.

TABLE V
P.F.I. CHANGES DURING 1933–34, BY ACADEMIC CLASSES

Class	Number of Pupils	June 1933	June 1934	P.F.I. Gain	Per Cent Gain
Freshman	142	97.83	101.76	3.93	4.11
Sophomore	174	99.52	101.5	1.98	1.99
Junior	145	94.79	96.33	1.54	1.62
Senior	84	90.46	95.08	4.62	5.17

(The above table represents students, who were tested in the various classes designated, both in 1933 and 1934. Irregular entering or leaving students were left out, so that a more accurate estimate of loss or gain in P.F.I. might be ascertained.)

The changes by P.F.I. groups are also given in Table VI.

2. **Specially Tested Group.**—Any pupil in group C may, in January, be retested at his or her request and be "graduated" from this group for the remainder of the academic year. Table VII shows what happens.

3. **Special Cases.**—Case reports often illustrate and reveal more than averages. Therefore, five outstanding problem cases are reviewed briefly below, to indicate what is done in the "adjustment" field as well as in simply improving physical powers.

TABLE VI
P.F.I. Changes During 1933–34
by P.F.I. Groups

Group	Number Girls	Av. P.F.I. 1933	Av. P.F.I. 1934	P.F.I. Change
A	77	119.39	114.35	—5.04%
B	110	94.36	95.8	+1.44%
C	65	68.43	72.72	+4.2 %
Group	**Number Boys**	**Av. P.F.I. 1933**	**Av. P.F.I. 1934**	**P.F.I. Change**
A	61	114.48	118.28	+3.8 %
B	110	98.9	98.75	— .15%
C	61	76.74	82.44	+5.7 %

TABLE VII
Results of Mid-Year Retests

Twenty-four students elected to be retested in January 1934 with the following results.

Case	June 1934	January 1935	Case	June 1934	January 1935
1	79	96	13	82	68
2	79	82	14	82	94
3	42	49	15	84	98
4	93 D.C.	111	16	66	85
5	85	87	17	84	89
6	78	90	18	85	94
7	81	89	19	70	67
8	84	95	20	84	81
9	66	78	21	82	95
10	82	91	22	81	91
11	77	95	23	85	95
12	84	98	24	83	82

Case 4 was in this class because of a Doctor's Certificate. His last test was that recorded 93.

Case 3 (overweight) is that of a girl who scored 39 on her first P.F.I. test. Has lost considerable weight and has moved up 10 points, but only 7 points since last June. Average P.F.I. 1934—79.08. Average P.F.I. 1935—87.5.

1. A boy, P.F.I. 62 displayed many anti-social tendencies in gymnasium classes. Upon investigation we found he was not attending an English class because of his refusal to carry out assignments given in class. While in conference with this young man he told the writer in very strong language that he knew where he could get into college without English. He didn't want to put on a gym suit, because he said he looked funny dressed that way. Our small classes and individual-need objectives permitted us to study this boy and work out a solution. The result is the boy

now puts on his gym suit and enjoys his work and is elated over the fact that he has at times been chosen to lead a squad in group work.

2. A girl whose P.F.I. was 43, weight 204 pounds, age 14 years and 6 months, was 71½ inches tall; to visualize this child one can understand why she developed anti-social attitudes. Avoiding others as much as possible, she would not enter into wholesome play situations without encouragement. Our physical educators were able to give her a great deal of help and guidance in the small classes and she began to get fun out of her work. Her P.F.I. moved to 51 then as a senior to 69. Since leaving school she has taken up tap dancing and has appeared in several church plays doing special numbers. She is now attending New York University, dresses noticeably well, weighs 175 pounds and is really a stunning young lady.

3. An only child, mother drove him to and from school in a car. Boy was very much upset in September, 1934, when he found himself in a low physical fitness group, requiring one period a day for physical education.

	June	June	June	June	
Years	1931	'32	'33	'34	—Jan. 1935
P.F.I.	93	91	89	79	96

His parents were irritated by this condition, presumably because of the boy's feelings. He had just been made a regular backfield man on our football team, and he and one other (tackle) were the only two football players in this group. After a conference he agreed to work with us and, as a result, in January 1935 he scored 96. His parents are very much pleased, now!

4. A boy who was putting on weight rapidly and was lazy. Suddenly he became interested in wrestling.

	June	June	June	June	
Years	1931	'32	'33	'34	—Jan. 1935
P.F.I.	77	75	68	77	95

He was willing to diet now and carry out our suggested schedule. He is now number one man (in his class) on our wrestling team, and has increased his P.F.I., as indicated above, 18 points or 23 per cent.

5. It is easy to see that the weight of this boy is responsible for his P.F.I. dropping.

	June	June	June
Years	1932	'33	'34
P.F.I.	65	56	45
Age	13	14	15
Weight	130	150	170

His present height is only sixty-five and one-quarter inches. Blame must be placed on home. Parents won't control the boy's eating or actions. His parents are not respected by the boy and consequently they can't get him to do things other boys do. It is a clear case of delinquency, but we feel we are now getting his confidence. He is keeping a daily weight chart, and may have something interesting to report in June, 1935. These stubborn cases often become, later, our most satisfying ones!

The lack of valid, highly reliable, and properly normed tests of social efficiency[2] renders impossible any adequate report concerning the social development of Lynbrook boys and girls. Even with such tests, it would be well-nigh impossible to separate the effects of physical edu-

[2] See Chapter VII of *Fundamental Administrative Measures in Physical Education* for a subjective test of social efficiency and cultural appreciation.

cation from those of other activities. Nevertheless, the above cases are samples of what is done at Lynbrook.

4. **Growth in Cultural Appreciations.**—Unfortunately, too, tests are lacking to determine how many and what type and quality of cultural appreciations are given pupils. The activities and numbers of pupils who participated, as listed on page 11, indicate the cultural breadth of the program.

SUMMARY

The "Lynbrook Program" is outstanding, if at all, chiefly in two respects: first, a balance is maintained in programs to achieve *all* educational aims. Physical fitness is cared for because without health pupils are impotent—and the greater are their P.F.I.'s (within limits) the greater are their capacities for study, play, activity, happiness, life. But the learning of skills, strategy, the conduct of games, selection of sports, initiative, etc. are not neglected. So, too, is there a definite attempt to broaden culture by leading pupils to engage in a wide variety of activities and on "higher levels." Nor are anti-social traits of selfishness, etc. taught by over-emphasizing winning in games and sports.

The second feature of the Lynbrook program is the measurement of needs and proving of results wherever objective tests are available to perform this vital service. Lynbrook recognizes and acts on the law that *orderly* (*economical or effective*) *progress toward any remote goal in education depends on measurement.*

Notes on "D" Classes

By B. North Parsons and Harold W. Herkimer

DEFINITIONS AND PURPOSES

IN THE terminology of New York State physical educators, "*D*" pupils are those whose physical fitness is very low. "The lowest fifteen (or 20 or 30) per cent of the school, no matter what the P.F.I. level," "P.F.I.'s below eighty-five," "all pupils needing special guidance to eliminate or reduce physical defects, whether of strength, posture, vital organs, or skills" are various local and specific definitions of "*D*" pupils. The most generally used definition includes as "*D*" pupils *all with P.F.I.'s below eighty-five and all selected by other medical and physical tests as needing special guidance to increase physical strength or to remove growth handicaps.*

These pupils in New York junior and senior high schools are required to attend special "corrective" or "developmental" classes three, four, or five periods weekly, depending on local facilities and instructional services. Of course, the object of this procedure is to select for special care those pupils most in need of attention by physical educators. Segregation or homogeneous grouping makes it possible for teachers to meet more effectively the peculiar needs of these physically deficient pupils.

COMMON OBJECTIONS AND QUESTIONS

Physical educators throughout the nation often make certain objections and ask typical questions concerning this so-called "corrective" program. The most common of these are listed below. This entire paper is evidence that most of the objections are unimportant.

1. *Do "D" pupils dislike to take corrective work?* Our six years' experience is quite otherwise. If preliminary explanations are made to both parents and pupils, the latter are actually enthusiastic supporters of programs which require them to attend classes four or five times weekly, while others with higher P.F.I.'s attend one or two periods weekly.

2. *Does segregation into homogeneous groups of "deficients" embarrass pupils so segregated?* Our experience is that but few pupils entertain such sentiments.* Rather are they happy to be so placed that they may quickly remove their deficiencies. And do the rest of us feel disgraced if disease or accidents send us temporarily to hospitals?

3. *Is not homogeneous grouping an outmoded technique?* Our experience at Niagara Falls would not permit us to abandon our belief in

* See Clark's report for Melrose High School on page 111.

the efficacy of this technique. The most recent studies and analyses in this field indicate plainly that homogeneous grouping in terms of true needs is increasing.†

4. *Do you find it difficult to schedule pupils in your* "D" *groups?* Not if the principal is convinced of the value of such grouping and physical educators are willing to give the added time and effort required.

5. *Do parents coopcrate for correction of defects and change of habits of diet and sleep?* Yes, to the best of their ability. It is also possible to arrange for outside help such as clinics, service clubs, etc., for procuring such correction.

6. *Do parents inquire about the strength tests?* A small number did when the tests were first introduced—an occasional one since. This contact offers a valuable opportunity to explain the program to parents.

THE NIAGARA FALLS PROGRAM

The values of medical and physical examinations and of determining the physical fitness ratings appear in the adjustments made and results accomplished after these are done.

The first item in the Niagara Falls program is that of class assignment into homogeneous groups. This is not difficult, as our principals are "sold" on the possibilities of the program. With their cooperation, ways are found to make the necessary assignments. The best way to get the assignment of pupils to *"D"* groups is to make these assignments *before any other part of the students' programs is arranged.* This is done at Niagara Falls.

With the above agreement, the physical educators make out their daily programs of classes. The principal then assigns pupils to *these classes* as he desires them. *This must be done before the individuals appear for assignment.*

To accomplish this, pupils are given P.F.I. tests just before the spring semester ends. Of course, pupils segregated by medical and posture tests are added to those with low P.F.I.'s to form the *"D"* groups. These two items arranged, it is then comparatively easy to take care of the entire student body in a short time when it appears for program making. Each pupil's assignment in physical education given him, either for class *"D"* (four periods weekly at certain stated hours), class *"B"* two periods weekly after school), or class *"A"* (complete freedom or intramural activity), he moves on to the various academic assignments.

Delays and conflicts are almost eliminated by this method. But to make it so, the physical educator must do real work in the preliminary arrangements. After one or two experiences of this nature, the carrying out of the registration is almost a routine proposition.

† See particularly *Provisions for Individual Differences, Marking and Promotion* by Roy O. Billett, Monograph No. 13 of the National Survey of Education, The Office of Education, U. S. Department of the Interior, 1933; and *The Perennial Grouping Problem,* F. R. Rogers, *School Executives' Magazine,* October and November, 1934.

Beginning in 1929, the high school pupils have been classified according to physical fitness, determined by physical fitness tests. The ratings in these tests determine the number of times a pupil is required to report for gymnasium work, varying from one period a week to four.

Once the classes begin to meet the real work begins. As we are concerned in this paper with only the "*D*" group, our remarks will pertain, now, to them only. These groups meet four times weekly, but before any real work is commenced each of these pupils has a thorough physical examination by the school physician. Immediately after this is completed, a conference follows with the physician, physical educator, and pupil present. Sometimes an additional conference with the parents is advisable. From these conferences the program is determined. Cooperative efforts may also be necessary with nurse-teachers, dental hygiene-teachers, dentists, psychiatrists, orthopedists.

Activities in "*D*" classes vary from individualized programs to correct posture defects to group "workouts" to improve the strength of all muscles of practically all pupils. After careful examination by the physician, students are grouped according to postural and large muscle needs. For example, student *X* has been examined by the physician and found with excessive adipose tissue through the abdomen and back accompanied with lordosis. Upon referring to his strength test card it is found that his back lift is low. This boy is placed in a group where special exercises are given to strengthen the abdominal and back muscles and improve the postural defect. Similar groups are made up of boys of low arm strength, leg strength, etc. General exercises for all large muscle groups are given to the class as a unit.

This procedure is followed by the teaching and playing of a seasonal program of games—primarily those with acknowledged carry-over value.

RESULTS

The best evidence of the success of the Niagara Falls corrective program is the steady rise in physical fitness of all pupils as shown in Table I below.

Since 1932 the number of pupils decreased in number, but it will be seen by the curve of distribution for 1934 that there has been a notice-

TABLE I

PHYSICAL FITNESS INDICES OF NIAGARA FALLS PUPILS

Class	June 1929	Feb. 1, 1930	Feb. 1, 1932	Feb. 1, 1934	Feb. 1, 1935
A	70 and above	95 and above	100 and above	100 and above	110 and above
B	55 to 69	70 to 94	84 to 99	86 to 99	89 to 109
C	45 to 54	50 to 69	71 to 83	86 and below	76 to 88
D	44 and below	49 and below	70 and below	———	75 and below

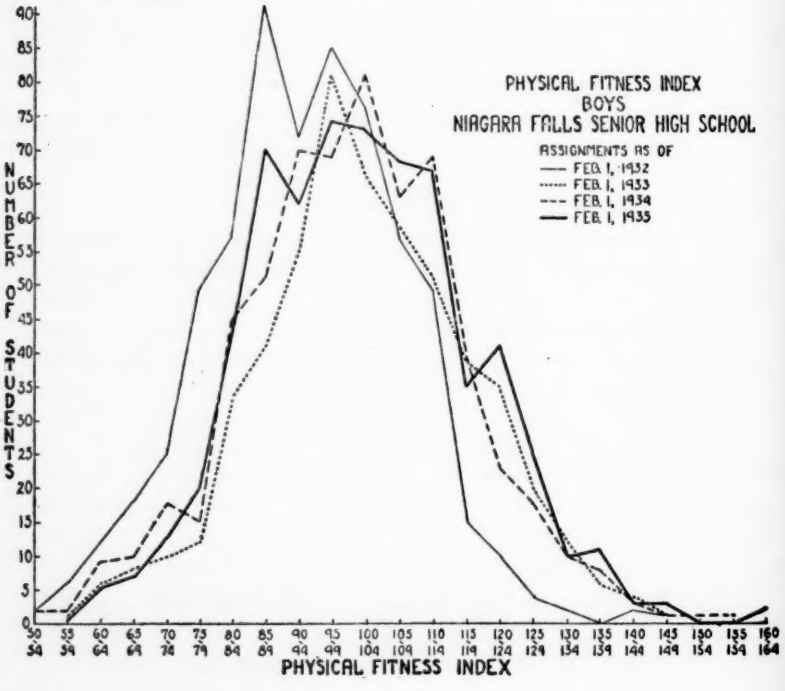
able shifting toward better physical fitness among the pupils. In 1932, the high point centered in the interval of 85-89 while in 1934 the high point has shifted to the interval of 100-104. In 1934 there were more with higher indices and fewer with lower indices than in 1932 as the curves show. This readily shows an improvement in physical fitness among our students from January, 1932, to January, 1935.

From January, 1932, to January, 1935, the median P.F.I.'s for each year were:

Year	*Median P. F. I.*
1932	87.02
1933	98.46
1934	100.74
1935	98.52

These medians and curves tell a highly significant story, for they not only reveal a steadily increasing fitness for Niagara Falls pupils of nearly fifteen per cent in four years; they also demonstrate the wisdom of concentrating on the low or *"D"* pupils. Nor has this policy affected adversely the physical powers of the high P.F.I. pupils, as some critics aver. There has been an upward shift on every P.F.I. level.

The statistician will be struck by two features of the distribution curve—(*a*) the extreme upward shift for 1933, and (*b*) the concentration of P.F.I.'s about the median (or reduction of the σ) for 1935.



The concentration of P.F.I.'s about the median is precisely what P.F.I. theory desires. *Mens sana in corpore sano* suggests the coincident development of both mind and body. Pupils with P.F.I.'s below eighty-five are too weak to carry on efficiently in academic programs: if their physical powers are increased, they will become proportionately more efficient scholastically, while if physical education is neglected, they are likely to lose progressively at least some of the remaining mental power they have. Contrarily, pupils with very high P.F.I.'s are *overdeveloped* physically. To become so, moreover, they must devote to physical activity time and vitality that ought to be given to mental functions. A lessening of physical activity for these is indicated, and therefore a dropping of P.F.I.'s, *concentrating P.F.I.'s about the median.* This actual consummation has already been effected at Niagara Falls.

SUGGESTED PROCEDURES

The authors have added here a few suggestions to guide physical educators who wish to introduce *"D"* classes and lack experience.

1. Give medical examinations before any P.F.I. tests are given, and classify as *"D,"* all pupils prohibited by physicians from taking strength tests.

2. Remember that a physician's certificate of unfitness to take regular work is *prima facie* evidence of great need for *"D"* classification. (This policy effects marvelous cures!)

3. The physician should recommend to the physical instructor the type of work each individual needs.

4. In cases of obesity or undernourishment, the physician should advise the student, physical instructor, and parents concerning proper diet and health habits. Advice pertaining to diet should be strictly in charge of the physician.

5. Cases of physical defects should be brought to the attention of the parents and cared for as soon as possible. This is most satisfactorily done by a personal conference with the parents.

6. Conferences of the physician, pupil, and physical instructor should be held at intervals to verify the recommended program and make constructive changes.

7. Physical instructor and pupil conferences should be for the purpose of pointing out the part or parts of the body that need strengthening, the type of muscle activity proposed to bring about that improvement. From time to time repeated tests should be given to show the improvement.

In recording conferences, a sheet similar to the blank illustrated below should be used. An accurate and full record of the conferences, program, etc., is necessary to follow up the pupil intelligently.

PHYSICAL AND HEALTH EDUCATION DIVISION

Class "D"

Health Guidance

Name..... Age.....
Address..... School..... Grade.....
Student referred by.....
Physical Examination by Dr.....
Doctor's Conference-Recommendations .....
.....
Student's Suggested Program .....
.....
Parent and Child Conference with Doctor or Physical Educator—Date.....
Result .....
.....
Results .....

SECURING PUPIL COOPERATION AND INTEREST

1. To reach any desired educational goal it is first necessary to develop interest and cooperation on the part of pupils. In *"D"* classes it will be found much easier to accomplish these administrative and teaching objectives if pupils attend class every day. The close proximity of one day's work to the next has a salutary effect on pupils.

2. Members of *"D"* groups discover through the testing program that they are falling below the standard of physical fitness for normal pupils. Immediately they become "physical conscious." With this consciousness comes a strong desire to improve their physical fitness.

3. It is always a source of great pride to boys particularly to feel that they are in fine physical condition. In fact, boys usually have a tendency toward a "feeling of physical superiority." That is, they usually imagine themselves to be above average, no matter what their true status. Therefore, it is only natural after the testing that *"D"* pupils should be surprised when they find themselves in low physical fitness groups. However, *they are not disheartened but realize that they must take steps to reach the level of their fellow pupils*. This desire to improve adds a great stimulus to interest in proper and systematic exercise. Therefore they enter into the program wholeheartedly. Physical educators ought to encourage the pride of pupils in good physique, but of course within proper limits.

4. This group manifests the greatest interest in its program. *"D"* pupils are anxious to have the gymnasium opened early in order that they may prepare for their daily work as early as possible. Their desires should be met by full cooperation on the part of teachers and principals.

5. The benefits of the entire program are manifold. Students, particularly those in the lower groups, have greatly increased interest in physical education. They like to watch their improvement—the actual benefit as shown by the figures of the tests can be seen and appreciated.

This is the real motivation which this program provides. Therefore, opportunities for retests should be given at frequent intervals.

6. Pupils realize that their improvement is due to better health habits or to the removal of some defect or to both. Teachers should aid slow pupils to join cause and effect.

7. Interest is also developed through the realization by weaker, timid, or athletically inexperienced students that they are in a class with those of more nearly their own ability instead of being in a class with those of greater ability who monopolize the time and activities of teachers. These advantages should be made clear to pupils at the beginning of each term.

COMMENTS BY TEACHERS AND PUPILS

1. "The testing program in physical education is superior to any program used in our high school." (A teacher.)

2. "To require every student to take two gymnasium periods and only two a week is comparable to a physician prescribing the same method of treatment for all his patients." (A teacher.)

3. "Only through tests can students be homogeneously grouped and a progressive and beneficial program carried on." (A teacher.)

4. "Excuses from gymnasium are seldom requested by this group." (A teacher.)

5. *Student Reactions:*

Are four gymnasium periods better than two?

"From my own experience I would say that four gymnasium periods a week are more beneficial to the individual than any number under four. For one year I was classified in the *"D"* group and took four gymnasium periods a week because my strength index was far below normal. Without a doubt I know that those periods were the best I have ever taken. I enjoyed those periods more than any I was ever in before or since. I benefited a great deal physically which is indicated in my increased Strength Index. When I look back on those gymnasium periods, I recall many pleasant memories." (A pupil.)

"Although I was skeptical at the outset of my high school years as to the benefits of four gymnasium periods a week for myself, I am glad to say any doubt I entertained was soon dispelled. I watched myself develop remarkably during the time I was in the *"D"* group. I can attribute it to the regular systematic physical training I received while in the class." (A pupil.)

Meeting the Individual Physical Needs of Girls in Junior and Senior High Schools

By Helen M. Chesky

INTRODUCTION

TO THE writer, junior high school girls are the most interesting and satisfying individuals with whom to work for health improvement, or indeed for the raising of any physical abilities. They are almost invariably intensely pleased to discover that many little (or big) physical defects may be removed by proper exercise, rest, modification of diet, or some other change in behavior which costs nothing more than mental and physical effort. They throw themselves wholeheartedly into these corrective projects and cooperate splendidly.

And this is fortunate for physical educators especially, for several reasons, among which the following are impressive:

First, the prime duty of physical education is to conserve girls' physical powers and to make them more healthy, more graceful, more attractive.

Second, girls vary in physical powers quite as widely as they do in mental powers. The literature of mental education is already crowded with reports of successful experiments in the individualization of instruction to meet the varying needs of each pupil; the literature of physical education ought to be just as great. If it is necessary to treat individual mental needs differently, it is at least as necessary to treat individual bodies differently.

Third, girls tend to *acquire* defects as they grow older. This is obviously true of dental defects; it is quite as true of posture, flat feet, the power of muscles, the nutritional status of the body. Many of these defects are insignificant before pubescence. Many, even if present, cannot be treated effectively before this stage of development is reached. Many begin to appear with the onset of this metamorphosis. "A stitch in time saves nine," applies as well to a girl's physical attractiveness as to her social charm.

Fourth, it is unfortunately true that every advance of civilization brings with it a new threat or positive handicap to normal growth—which must be checkmated by some artificial civilized adjustment or health will decline. The physical educator is best fitted by training, experience, and duty to meet these ever-increasing challenges to health, which affect girls perhaps more than boys.

For these, and many other reasons, the writer welcomed the opportunity presented by her city Supervisor of Physical Education* to modify her junior high school program to meet her girls' individual health problems. The work was begun at the Oneida Intermediate School and was later continued in the Nott Terrace Senior High School, Schenectady, New York. Several reports of this work have been made to local and district physical education associations. This report summarizes the procedures followed by the writer, without statistical treatment of any data. Its purpose is chiefly to give readers some insight into the possibilities of meeting girls' individual needs in typical schools.

PROCEDURES

1. The Oneida school is a typical building, constructed in 1927, with one gymnasium for both boys and girls. Crowded conditions are the rule. Apparatus is meager and lacks variety. Nevertheless, the crowded facilities were not permitted to handicap the program. The writer's interest in this program is the outgrowth of contact with over four hundred girls in this school.

2. P.F.I. tests were given by trained teachers with pupils recording and assisting. Tests were given in two parts—lung capacity, grips, push-ups and pull-ups one day, back and leg lifts the next. The procedure of giving all tests on the same day seemed too fatiguing to these girls, ranging from ten to sixteen years of age. Of course, those suffering from heart, appendicitis, or temporary illnesses of any nature were excused from tests until they had recovered.

3. The testing program revealed that a large percentage each year were, for one reason or another, extremely low in P.F.I., while a good percentage were quite high. The actual percentages varied from year to year with an average of about 30 per cent below ninety P.F.I. points for each year.

4. Crowded conditions prevented the principal from classifying pupils according to P.F.I. and sending them to segregated groups. Therefore, the instructor attempted to segregate the low P.F.I.'s on the gymnasium floor. The usual squad method works well. Divide your girls into squads in terms of their P.F.I. levels rather than by height or age or grade or other less significant measures.† The Oneida plan, however, was to further subdivide pupils in terms of their scores on the various tests; for example, placing together those whose arms were weak, etc.

5. The first step in class work was to explain the meanings of P.F.I. tests and scores to all girls. The I.Q. parallel was used because of girls' familiarity with its use in academic classes. However, instructors stressed

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* Everett T. Grout. The program has since been carried forward by Assistant Superintendent of Schools, John H. Burke, M.D., in charge of health education.

† This procedure has the added merit of dividing girls in terms of general ability, as is demonstrated in Wellman's report on *"The Validity of Various Tests as Measures of Motor Ability."* See page 19. (Ed.)

the difference between the two: whereas the I.Q. remains the same, the P.F.I. may be doubled in a few months, thereby doubling a girl's capacity to "do things," study, exercise, work, and, therefore, to enjoy herself. It was emphasized that girls whose P.F.I.'s were low should not be discouraged. But it was also pointed out that their cooperation and the unceasing work of the instructor were necessary, *first*, to discover just why the P.F.I. was low, and *second*, to remove whatever deficiencies existed.

6. Succeeding steps in classes were along the lines of modifying a part of each period to meet the individual needs of all girls. Those needing more active programs were put in heavy gymnastics; those needing posture corrections were treated for these defects. In general, the program consisted of graduated activities on ropes, poles, rings, buck, hanging, and traveling exercises on the horizontal ladder—as well as games and dancing.

7. Pupils who remained obviously weak were made the subjects of special investigations or examinations by the school nurse and physician. If their reports were that home conditions, food, and organic functions were normal, then the exercise program was continued. If special defects or bad habits apparently interfered with growth in P.F.I., of course these became the subjects of special study, and efforts were made to remove them.

8. The physical directors kept in close touch with home conditions and knew each pupil's habits and attitudes towards work, study, and playmates. This knowledge was of inestimable benefit in determining and guiding individual programs.

9. At the end of the year a chart was made of P.F.I. records in September and May, and changes in each test score were calculated and added to the chart. This chart then became the guide to later modification of each girl's program. An excerpt from this chart is shown as Table I.

RESULTS

1. The chief handicaps to the improvement of girls' P.F.I.'s as they appeared in this school were:

a) Laziness, due to rapid growth or bad habits at home and in school.

b) Overweight, which induced laziness or genuine fatigue and, therefore, curtailment of exercise.

c) Glandular malfunction, which prevented instructors from assigning exercise.

d) Indifference, brought about by home environment creating the belief that all forms of work are drudgery rather than pleasure.

e) Low intelligence, which prevented some girls from comprehending the value of good physical condition.

f) Illness, which curtailed activity, sapped vitality, and otherwise

TABLE I

SEPTEMBER AND MAY P.F.I. RESULTS FOR GIRLS IN THE ONEIDA SCHOOL

	Age	Wgt.	Hgt.	Pull up	Push up	Arm str.	Lift leg	Lift back	Grip lt.	Grip rt.	Lung cap.	Str. Ind.	PFI.
Irene K.	14-6	104	67	1	6	119	220	260	60	60	170	989	92
	15-1	110	67	0	6	108	170	210	70	70	170	798	74
		+6		−1		−11	−50	−50	+10	+10		−191	−18
Helen M.	13-11	95	59	1	5	54	210	150	50	50	120	634	74
	14-6	95	60	1	8	90	390	170	50	50	130	880	101
			+1		+3	+36	+180	+20			+10	+246	+27
Beatrice H.	13-4	93	60	8	1	81	300	190	45	40	128	784	98
	13-9	105	63	5	0	70	210	150	60	50	140	680	71
		+12	+3	−3	−1	−11	−90	−40	+15	+10	+12	−104	−27
Marjorie J.	13-2	163	62	4	1	90	420	270	60	90	172	1102	67
	13-7	182	62	4	0	80	370	265	60	80	164	1019	56
		+19			−1	−10	−50	−5		−10	−8	−83	−11
Marian W.	12-2	130	62	0	0	0	250	170	50	60	130	660	59
	12-9	133	63	0	4	64	360	180	60	60	158	882	72
		+3	+1		+4	+64	+110	+10	+10		+28	+222	+13
Mary S.	14-1	141	62	1	0	16	200	190	55	65	136	662	71
	14-8	152	64	0	0	0	310	190	55	65	128	748	46
		+11	+2	−1		−16	+110				−8	+86	−25
Virginia J.	11-5	125	63	1	0	16	250	160	50	50	136	662	66
	12-3	139	65	8	0	152	270	190	50	50	156	868	74
		+14	+2	+7		+136	+20	+30			+20	+206	+8
Minnie S.	13-3	110	62	15	3	234	315	210	65	55	172	1051	108
	13-8	118	62	12	4	208	260	160	85	85	158	956	86
		+8		−3	+1	−26	−55	−50	+20	+30	−14	−95	−22
Rose D.	13-4	143	64	0	1	18	325	200	65	70	190	868	68
	13-11	159	64	0	3	60	410	250	75	70	210	1075	63
		+16			+2	+42	+85	+50	+10		+20	+207	−5

both reduced amount of exercise and restricted the capacity of the body to respond.

2. In spite of these handicaps, much was accomplished. The physically handicapped were reached *as individuals*, their defects were often removed, and their health improved greatly as indicated by P.F.I. test results, as well as by other less objective measures.

3. As the girls low in P.F.I. pass on to senior high school, other follow-up programs effect even greater changes. Their P.F.I.'s increase; overweight pupils discover the benefits and joys of eliminating surplus fat and modify their diets more effectively (the strongest appeal is usually, and not improperly, the desire for personal attractiveness). Pupils with high I.Q.'s but low P.F.I.'s discover that being balanced both mentally and physically is an asset to college and later life. Unfortunately the indifferent girls seldom continue through high school. Consequently their fitness tends to drop steadily.

4. What happens to girls with high P.F.I.'s? *They tend to remain high.* Very few lost many P.F.I. points during junior high school years in the Oneida school program. Occasionally illnesses force P.F.I.'s down. Sometimes the best athletes drop because of changed study programs, or affairs of the heart, etc.; but all in all, the chances are that high P.F.I.'s remain high.

5. What is the relation between over-and under-weight and P.F.I.? There seems to be little relation—probably no more than there is between height-weight ratings and true nutritional status.§ Many girls apparently underweight had high P.F.I.'s. Their physical condition seemed excellent. A few apparently overweight girls also had high P.F.I.'s, while many of normal weight for age and height had low P.F.I.'s.

6. Girls, as well as boys, are interested in the P.F.I. tests, if the latter are properly used and if girls are properly instructed in their meaning. In practice, girls would spur each other on to better performances. They were interested in checking their own records against former scores. If they failed to surpass previous marks, the usual request was "May I try again? I know I can do better," etc.

7. As examples of individual analyses and results, the following case reports are summarized below. (These are the individuals listed in Table I.)

Irene K . . . was an excellent scholastic student. She was not robust looking, but was organically sound. Her height was 67 inches and her weight 110 pounds. She was in the period of accelerated growth. Acquiring this height rapidly, she was becoming stoop-shouldered, so typical of the type. In every test given she lost with the exception of a little gain in the grip tests. What she needed was rest from all physical activity. Her body needed strength for her rapid growth. Because of her physical condition she was not very enthusiastic about sports either

§ In this connection see Raymond Franzen, *Physical Measures of Growth and Nutrition*, Chapter II, and the following pages in this Supplement.

as a participant or an onlooker. Perhaps in her high school or college career her physical condition would warrant participation in some sport.

Helen M . . . was another excellent scholastic student. Her first tests were low. She was an honor student, devoting more time to studies and music than recreation until she almost had a nervous breakdown. Her family physician suggested to the family that she ease up on studies and other activities and participate in outdoor activities. She came out for sports and in one term did splendidly and gained a few points towards raising her P.F.I. But, of course, when it came time for graduation she dropped all athletic activities, and when we retested her for the third time she dropped lower than the first time she was tested. The summer after graduation she was recovering from a nervous breakdown.

Beatrice H . . . was a slow student, not especially interested in athletics. She always complained of being tired and wanted to be excused from all types of gymnasium work. A thorough checking with the doctor showed a cardiac condition following an early case of scarlet fever. It was not a wonder that she kept dropping a few points in all tests. If pupils drop too much in each test, it is not wise to encourage them to make greater efforts until a further medical check-up can be made.

Marjorie J . . . decreased in everything. The cause for this was her tremendous weight of 182 pounds. We sent her to the hospital for metabolism tests. She was placed under a doctor's care. Marjorie was very much interested in herself. She tried to participate in all events, but her weight was a handicap. (I might note that I saw her two years later and she had lost forty pounds, having become an expert swimmer and having won places in many amateur meets.)

Marian W . . . was very low in the first test. She gained some in the second tests. She complained of tiredness, and I knew she was not lazy. I was very much interested in this girl and had a conference with her mother. Because Marian thought that she was gaining, she left out certain foods which she needed for growth. As a result, she was becoming tired because of anemia developing. Her mother checked on her diet, and in school we encouraged some rest and asked her to participate in some light activities. We also got her interested in taking a course in home economics so that she would learn food facts and what foods did to the body. When she was retested she gained in everything but pull-ups.

Mary S . . . was low in both tests. Her trouble was a loose knee-cap that slipped occasionally; consequently she was afraid to participate in activities. She had an operation, was excused from gymnasum work for a term, and then reentered classes and participated in some sports. In the third test she gained a few points in all tests and was very much pleased. At the time she was excused for one term, she attended all classes and watched the work and learned rules of various games. In her eagerness not to be left out of things, she acted as scorekeeper or timekeeper. She was very anxious to overcome her handicapped condition and she succeeded.

Virginia J . . . was a good scholastic student, who tried very hard to participate in all games. She lacked coordination, but never gave up hope. In spite of gaining fourteen pounds, she increased in every test except that she made no showing in push-ups in either test. She was a well-balanced student, and in spite of her lack of coordination, entered all events with a great deal of interest. Virginia may never raise her P.F.I. because of her low arm strength, but her enthusiasm will carry her a great way.

Minnie S . . . was an excellent athlete. Her first test was fairly good. In the second test she dropped from group *B* to *C*. We discovered from the nurse's records that she had bad tonsils and was subject to many colds. With the approval of her parents she had her tonsils removed. After that she gradually started on the upward grade again.

Rose D . . . dropped a few points in her Strength Index in spite of a great gain in all tests. Her weight increased sixteen pounds, which made her normal strength index higher. I did not worry about her because her enthusiasm in her work did not lag. What difference did a few points make as long as she was well, physically strong, and participated in all desirable activities? Her parents did not want her to diet to lose weight. As long as she was active, they said, she would eventually attain her normal weight.

THE NOTT TERRACE HIGH SCHOOL PROGRAM

In the Nott Terrace Senior High School, we have for the past 4 years carried on a different program. We give P.F.I. tests to every girl who is registered for physical education (about 950 girls), asking as usual about appendicitis attacks, hernia, etc. With our test records to work on and a few months' leeway before the next tests, we are securing as many follow-up medical examination records of low P.F.I. girls as possible. We are also examining, as far as time permits, the posture of all girls in the *D* group (with P.F.I.'s below 85), the posture of the girls in *C*, *B*, and *A* groups being tested later. Posture defects appear in every P.F.I. group. Many amazing discoveries were made. At the present time we are exploring further the low P.F.I. girls and the results of the posture examinations for 1935. A few characteristic case studies are given below.

Rose F . . . . Rose's P.F.I. rating for three years at junior high school was *B-B-C*. The reason for the drop to the *C* group was a decided drop in back and leg lift; the grip tests dropped also. In high school a decided decrease in back and leg lift was noticed. At all times lung capacity was low. Weight was average for height and age. Further investigation revealed that Rose had flat feet and kypholordosis with all its accompanying stigmata. Her spine lacked flexibility, and she was limited in certain leg and joint movements; e.g. she could not sit tailor-fashion. Her knees were customarily near her chest, and she just could not stretch so that she could sit erect with the knees down. (Perhaps the Y-ligament had something to do with it?) This girl is now in a corrective class, very much interested in her condition and doing everything to overcome this handicap of poor posture. If we cannot adjust her posture, we will at least strengthen and lengthen her muscles and further stretch the ones that tend to shorten, and will improve her flat chest, endeavoring to improve the muscle tone to give her a better chest expansion, when her lung capacity will be increased. She takes foot exercises to tone up her muscles and then special exercises to tone up her back. She had been photographed, and at the end of the term she was photographed again and she herself was able to see that she had improved. Self-correction in front of a mirror has performed miracles for her. Her mental attitude is such that she sees improvement every time she looks at herself. If only more had that attitude, wonders could be accomplished. Her P.F.I. has lately increased.

Anna C . . . was in class *C* for three years during her junior high school work. She was in class *C* for two years in senior high school. She has remarkable arm strength because she works hard at home, but her back lift and lung capacity are very low. This results in a fatigue posture. She is also flat in the lumbar region. Flat feet accompany all these conditions. She has been photographed. She is now in a corrective class. We are interested in improving her posture and in having her P.F.I. increase steadily.

Jean C . . . is a problem case. She was in P.F.I. class *B* in junior high school

work. In senior high school she increased her fitness to group *A*, then *B*. On examination, after noticing her decidedly high shoulder in street clothes, we discovered that she had a transitional curve. We are particularly interested in Schenectady in determining why some of these bad postural cases remain in a high P.F.I. group.

Martha B . . . is another unsolved problem. She rated group *A* for three years in junior high school and in group *B* two years in senior high school. She is underweight and has a most decided left total curve. Evidently her general physical fitness is high and the postural defect is not great enough to affect her fitness seriously.

Emily C . . . had three *D*'s in junior high work. In senior high school she has two *C*'s. She has a poor posture due to rapid growth and under-nourishment. We are trying to strengthen her body by exercises. She is under the nurse's supervision, drinking milk in school. Her continued low P.F.I. in spite of corrective procedures indicated a failure somewhere—at home, in diet, or in organic defects as yet undiscovered, or the need of a different physical educational program. (Possibly increase in rest and sleep two or three hours daily will help.)

RECOMMENDATIONS

The writer has added the following suggestions for those directors of girls' physical education who as yet still lack confidence in the value of individual work for girls, or in the utility of physical fitness tests for girls.

1. The most interesting and encouraging way to check one's work is to plan a chart of some description with one's own method of reporting gain or loss. The writer has used the method illustrated on page 105 in intermediate grades. We now have large cards which carry cumulative P.F.I. test records through intermediate school and high school. It is very gratifying to compile and study these records, for they usually show steady improvement in pupils. (The cases reported in this paper were selected as unusual problems.) Besides, it is only by means of some sort of a chart that one may check progress.

2. We found that in senior high school girls are more interested in "improving their posture" and in "keeping good health," whereas junior high school girls are interested in the P.F.I. itself. Of couse, the fact is that one does not greatly improve posture or health without its being reflected in P.F.I. increases. So by appealing to girls' feminine instincts for better health, improved posture, and a slim figure, we accomplish more than by reference to a mathematical calculation.

3. Physical fitness for girls is improved too by talks on personal hygiene, by discussions on the relation of diet to health, by giving reasons why good posture is essential for maintenance of health and appearance, by explaining to girls why exercise is necessary for a firm, muscular body. If girls do not wish to participate in extra-curricular school activities, we urge them to join outside organizations where they can enjoy and learn various forms of exercise. Swimming, horse-back riding, and hiking seem to be the most appealing activities.

4. We are always striving for a well-rounded program for girls and

ever striving to have them become "health- and posture-conscious"; we encourage them to participate in healthful sports, and bring out the fact that well-balanced living brings color to the cheeks, sparkle to the eyes, and a live, energetic body.

5. Try these methods and then retest your girls. You will be pleased to see their arm strength go up, their backs and legs grow stronger, their lung capacity increase, their total fitness improve. If you approach students in this manner, parents will cooperate actively and enthusiastically. How much better is such a program than a cut and dried formal lesson. The high school student must see and be shown what is happening. When she is convinced what it is all about, then all is smooth sailing.

6. If you can show the school administration that you are accomplishing something for the betterment of the pupils, you will receive their heartiest cooperation. Do not be satisfied with your work and stop. New ideas and plans to improve your work should be your aim.

7. Different methods of approach are helpful, too. Consult your school physicians and nurses. Perhaps together you will be able to hit upon some plan that may work splendidly to enlist girls' interests and active cooperation.

8. The cooperation of orthopedic physicians is of great help to physical directors, for through them you can improve your knowledge of muscles and their special functions. If you have had special training in orthopedic work, concentrate on corrective classes for your *D* group and others who may need the work.

9. Lack of facilities is no unsurmountable handicap to the purposeful director. Some have no gymnasiums; some have large classes and small gymnasiums. Equipment for either class work or corrective work is not absolutely essential. Devise your own apparatus. Find a space in a corner for your corrective classes. Play games in the halls, outdoors, or any available space. Use your judgment for seasonal activities.

10. Do not fear that strength tests will strain or otherwise harm your girls. In tens of thousands of tests at Schenectady during the past seven years not one girl has been really harmed. Of course many are stiff for a day or two after being tested if they are not in good condition. The anatomy of girls is really better adjusted to the strains of lifting weights than is that of boys.

Melrose High School Experiments

By Leonard Clark

THE WRITER offers these data and observations as examples of what may be done during a first semester's experiences with objective measurements in a modern high school.

Our Facilities.—Melrose High School is a thoroughly modern building, completed in 1934, to accommodate fifteen hundred pupils. There are separate gymnasiums for boys and girls, with proper directors' offices and attached "exercise rooms" which make excellent small gymnasia for corrective classes. Outdoor facilities are good too.

Our Staff.—The writer is alone in charge of all gymnasium activities for over six hundred boys. In addition he conducts intramural sports and is coach of the varsity basketball and track teams.

Our Class Schedule.—All boys attend gymnasium classes two days weekly. Last fall we arranged with our stimulating and cooperative principal, Mr. William D. Sprague, to require boys needing extra work to attend a third period, which is taken from their "*S*" or study hall classes. Classes run throughout the day, the writer conducting five different classes each day. Class periods are fifty-eight minutes long.

Our Program.—Last fall we tested all boys for the first time, using P.F.I. tests. Since it was impossible then to segregate the low P.F.I. boys we did the next best thing: placed them in the corrective room while others in their groups were exercising in the main gymnasium.

Our activity program for the general group ranges from sports to formal drills. Corrective activities are individually assigned. The school physician advises on these. Boys are also stimulated to do "home work in physical activity," or to modify diets, etc.

Handling Classes.—The writer, as reported already, meets all classes. During each period he shuttles between the corrective room and the main gymnasium. Of course, pupil leaders are extensively used. In the corrective room boys help each other and are critical in reporting to the director how others perform their exercises. In this work particularly, we expect boys to emerge heated to the perspiring stage. The work is arduous but stimulating.

STATISTICAL RESULTS

Corrective Classes.—One hundred and two boys were in corrective classes for 6 weeks between tests given in November and January. Of these, 92 were retested. Eighty-four gained in P.F.I., 6 lost, 2 remained the same. The median P.F.I. on the first test was 82.9. It rose to 95.7 on the second test— a gain of 15 per cent in six weeks. Of those

who gained, the average increase was 15.4 P.F.I. points. Of those who lost, the average decrease was only 3.8 points.

All boys with P.F.I.'s below ninety were included in the group. Of these only sixteen failed to reach ninety in the second test. Median scores in each test are reported in Table I.

TABLE I

Test	First Score	End of 6 wks.	Per Cent Gain
Lung Capacity	238 cu. in.	250 cu. in.	5
Right Grip	82.6 lbs.	95.7 lbs.	15
Left Grip	72.5 lbs.	90 lbs.	24
Back Lift	311.9 lbs.	367.3 lbs.	17
Leg Lift	481.5 lbs.	561.1 lbs.	16
Push-Ups	1.7 times	5 times	194
Pull-Ups	1.3 times	5.5 times	323

Entire School.—Tests were given to all students in the school in June, 1934, and February, 1935. The results are reported in Table II.

It is interesting to discover from the tests in what good condition these boys are. The writer has reviewed reports from other schools in New England and elsewhere. Therefore he would not be surprised to learn that some directors might question his data, since the average high school boy in New England seems to have a P.F.I. of about 110. Fur-

TABLE II

Date of Test	No. of Pupils	Median P.F.I.
June, 1934	616	111
February, 1935	618	124

ther west the median seems to be lower, perhaps about 100.

Two questions present themselves. First, are the Melrose boys actually so high? And if so, why?

Let me report some convincing facts:

1. Initial tests were given by trained testers from Boston University, using instruments which had been properly calibrated at the Massachusetts Institute of Technology.

2. We found 11 boys whose S.I.'s were over 3000 points in February. Their median age was 17.6, weight 164 pounds, Strength Index 3138, P.F.I. 139.

3. Many of our boys chinned themselves more than twenty times.

4. One boy pushed-up 40 times *and five minutes later* chinned himself 30 times. His S. I. was 4288, and his P.F.I. was 202.

5. Leg lifts of over 1000 pounds were common—*using standard in-*

struments and techniques. One 96-pound boy, fifteen years old, lifted 800 pounds in June and 795 pounds in February. (His father had once had a weight-lifting record at Harvard.)

Why are Melrose boys so fit?

1. The community is one of the most highly favored in the Greater Boston area. It is a small city of homes, set in the hills on the "North Shore," northeast of Boston. Parks and playgrounds abound. Swimming facilities are everywhere. There is no poverty. Community spirit is excellent. Schools are modern.

2. The new program was energetically directed towards physical improvement, and pupils responded eagerly. This was particularly noticeable after the director had announced that a second test would be given "in three weeks." The boys immediately wanted to have the instruments to test themselves, but were refused, of course. They wanted to know their old scores. These were given to them. They studied the method of calculating indices. Parents began asking for scores. Newspapers carried stories on testing.

3. The corrective class pupils were extraordinarily responsive. Many of these boys did work at home.

4. Great interest was aroused by an expedient used to increase the grip strength of a boy who had broken his arm and one of whose hands was consequently weak. The director bought him a rubber ball to squeeze "when he had nothing else to do." Soon other boys were squeezing balls until at last there were forty or so in pockets and bouncing on floors (to the annoyance of academic teachers sometimes we fear)!

5. The principal, and even the superintendent of schools, lent their active encouragement and material assistance. Other teachers became interested and athletic coaches cooperated. What else could happen but health improvement!

OTHER NOTES

Corrective Classes.—Many boys wish to remain in classes during the spring semester. (This group will include all boys with P.F.I.'s below 100.) For example, a post-graduate had begged the principal to excuse him from physical education. He was refused—and also by the superintendent of schools and the school physician. His P.F.I. was 81.

He was put in the corrective group—did not like it—improved a few points in November tests—became interested—worked—now P.F.I. over 100—wants extra periods of corrective work—has a "new lease on life."

Equalizing Teams.—Six touch football teams were organized on an equalized Strength Index basis. Each team played five games. All games ended either in tie scores or with the winners one touchdown ahead.

Casual Observations of Grip Tests.—It has often been said that

business and professional men have stronger grips than laborers. To check this the writer tested eight laborers working near the school. Their average grip strength was 111 pounds. Eight men teachers in the Melrose School had an average of 140 pounds.

The responsiveness of grip strength to minor illnesses was checked. Boys with colds dropped noticeably. One individual ill in bed with influenza dropped 50 per cent in grip strength. Five days later, the fever gone, he had regained practically all his lost gripping power.

The S.I. as a Qualification for Football.—The football coach, after observing testing in June, was so impressed with its significance that he announced the following rule: No boy with an S.I. below 1800 is eligible for varsity football.

This brought some boys to the gymnasium for special exercises and consequent improvement in playing powers. (The average S.I. of the first eleven men in 1934 was 2486.)

Just before the close of the football season the November tests showed that two football players were declining in P.F.I. This was brought to the attention of the coach with the suggestion that these players were probably "stale." The coach replied, "That explains it! I have been driving these boys lately, thinking they were loafing."

The boys were then excused from all practices for four days. When they were retested, they showed significant gains in P.F.I. (and S.I. of course), and played well in the final game of the season.

SPECIAL CASES

1. A 16-year-old boy weighing 162 pounds, had grip scores of 35 and 36 pounds, due to no deficiency which could be discovered other than lack of exercise. He was given a rubber ball to squeeze—in three months his grip strength had increased to 110 pounds with each hand.

2. One of the football players mentioned above had a P.F.I. of 119 before the season began. Early in November he was retested—his score dropped to 109. He rested five days, when his P.F.I. returned to 120.

3. A boy whose P.F.I. was 121 became ill—nausea—headaches. A retest showed his score to be 102. Doctors were baffled, but the physical director insisted, since the P.F.I. had dropped so far, that something was wrong. Finally an oculist was visited who discovered that the lenses in his glasses had twisted in their frames. Ten days later he was tested again; his P.F.I. had risen to 121.

4. Milking cows all summer raised one boy's grip strength from 126 and 118 pounds to 168 and 160 pounds.

5. A boy whose P.F.I. was 80 was interviewed. He had no recreative activities —studied in all spare time. His parents were interviewed and their cooperation enlisted. Three months later his P.F.I. had risen to 102.

This boy had been a difficult case, did not enjoy play or living. Was called "Shakespeare" by classmates. Could not throw or catch balls. He is now a normal lad.

6. A seriously overweight boy was caught in time. His scores were:

September	weight, 190	P.F.I. 73
November	weight, 186	P.F.I. 98
February	weight, 185	P.F.I. 101

This boy was graduated out of the corrective class, but feels so much better for his training that he has begged to remain in another term.

7. W.F. was a social problem—did not like physical education—independent—insolent to teachers and parents. His P.F.I., in corrective class, rose from 81 in September to 90 in November, to 139 in February! He was determined to "show the physical director what he could do." *He is no longer a problem.*

8. R.S. is a boy who was never out for sports before last year. A P.F.I. of 156 marked him as unusual. He joined the cross-country squad. His P.F.I. dropped to 147 in November but jumped to 182 in February. He is now the school's Number One Man in cross-country.

9. R.T. was discovered to have a P.F.I. of 222. He is 16 years old, height 64½ inches, weight 106 pounds. He lifted 920 pounds with his legs. We imagined that there was some mistake and retested him a few days later. Every score was about the same before, except leg strength which was 15 pounds higher. His P.F.I. was again 222—an extraordinary proof of the high reliability of Melrose testing.

The Measurement and Reporting of Results of Corrective and Developmental Physical Education*

By William H. Whiting

In 1931, the Quincy Superintendent of Schools and Director of Physical Education, believing that their local physical education program would be improved by certain changes, invited a specialist in health education to survey the local programs and recommend modifications.

Out of this survey came a *redirection* of one phase of the program: the organization of classes, modification of programs, and assignment of pupils to meet their individual health needs, and particularly the needs of those pupils whose physical fitness was low.

The program finally adopted classified pupils into three groups: those whose vitality was low or who had specific remediable defects, those whose general health was average with no remediable defects, and those whose health was excellent. It was planned that the "low group" pupils, whether tenth, eleventh, or twelfth graders, should attend physical education classes four days weekly; the "average group" pupils, should attend gymnasium classes one day weekly and participate in intramural or interschool sports; and the "superior group" pupils should engage only in sports after school.

To carry out this program effectively, several steps were taken which might seem to observers well nigh impossible. In the midst of the depression, additional gymnasium space was secured, teachers were employed, apparatus for testing purchased, tests given, and special follow-up examinations by physicians made. During the summer, the high school principal cooperated by reorganizing his school program—in an already overcrowded building built to accommodate fifteen hundred pupils, and, in 1932, accommodating twenty-two hundred. Pupils were assigned to physical education programs in accordance with their physical needs for the first time in the history of the school, and the program went forward as planned.

These developments involved the active cooperation of the School Committee in providing funds, of the Superintendent in analyzing and approving procedures, of the school health service staff in making examinations, etc., etc.

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* This article is a condensation of a pamphlet, *A Report of Progress*, prepared in 1933 for the Quincy, Massachusetts, Superintendent of Schools, James N. Muir, and his School Committee.

But what about results? Did the project pay? We may anticipate the conclusions of this report by quoting from the Superintendent's Report, *Some Facts Concerning the Public Schools; A Message to the Citizens of Quincy*. Speaking of the corrective program about to be discussed here, Mr. Muir said: "This item alone, in the physical betterment of Quincy's boys and girls, justified the money that has been spent in the whole experiment . . . The fundamental principle and purpose of the entire physical education program in the Quincy school system is to . . . provide the individual with that training which meets his individual needs. No two children are alike physically or, for that matter, in any other way, and to treat them as if they were is a grave injustice."

CHART I

BOYS' PHYSICAL FITNESS INDICES

Montclair High School

"Regular" Physical Education Classes

P.F.I. September 1924	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	
168																	0
160		Montclair H.S.												1			1
152																	0
144								1	1	1	2				2	1	8
136									2	1	1		1				5
128							1	1	1	4	2	2	2				13
120						2	3	6	8	10	5	1	1				36
112						3	7	11	13	13	4	1					52
104					1	10	18	22	14	5	3						73
96				1	6	4	16	8	7	6							50
88				3	7	13	9	5	2								39
80			1	6	13	10	6	1	2								39
72			2	4	8	2	1										17
64	1	2	6	3													12
56		1	1														2
48	1																1
	2	3	10	17	35	44	63	55	50	40	17	4	4	1	2	1	348

The purpose of this Report is to outline progress since May, 1932, in adapting physical activities to the physical needs of individual pupils in the Quincy Senior High School. *This report covers only one phase of the program: the correction of defects and improvement of vitality or physical fitness of those pupils most in need of guidance.* It would be highly

improper for readers to assume that the Quincy physical education program neglects other phases—for the development of social character, leisure-time interests, etc.

THE PROGRAM

In May, 1932, all pupils in the city who would study in September in the Quincy Senior High School were given strength and footprint tests. Immediately thereafter, those whose P.F.I.'s were below 85 were given thorough medical examinations to determine the causes of their low vitality. In September these pupils, and others who had flat feet, poor posture, or other physical defects, numbering 240 boys and 239 girls, were assigned to special physical education classes, each of which met four times weekly. To accommodate these special groups, new quarters were opened or rented in addition to the regular gymnasium areas in the High School, and the staff was increased and reassigned to care for the additional work entailed.

During the fall term these pupils with low vitality, or with flat feet or other physical defects, were given special activities designed to remove their deficiencies. Due to certain circumstances, over some of which the physical educators had no control, the corrective and developmental programs were somewhat handicapped, especially those for girls. There was, too, some confusion in the minds of teachers and others as to proper procedures. These administrative handicaps to effective programs may be overcome in the future.*

In general, pupils were given, during some part of each period, activities "more or less" specifically suited to their particular defects. During the other part, a general program of gymnastics, games, and sports was provided. The school physician, nurse, and dean of girls observed the conduct of classes several times during the term. It was apparent to them that, in many cases, pupils were not receiving the individual variations in programs which would be necessary adequately to meet their particular needs. These defects have been overcome in subsequent years.

It is especially noteworthy that the instructor for boys had an individual conference during October with each pupil, and that the instructor for girls did likewise, though with fewer girls and not so formally.

In January, all pupils in special classes were re-examined by physicians and retested by means of strength and pedograph tests. The results of these tests have been summarized and analyzed, and provide data for recommendations.

Comparisons of May, 1932, and January, 1933, Measurements Medical Examination Records.—Physicians' reports were somewhat indefinite due to the nature of their examinations and records. In general they report "improved condition," "general attitudes good," "posture improvement especially noticeable," "headaches fewer and menstrual

* The full report, of which this is a summary, discusses these points in detail.

conditions, dysmenorrhea and amenorrhea, greatly improved, for a few cases especially."

Physical Fitness Index Records.—The boys' records show, for 161 pupils tested in May and January, an average (median) increase of 21 P.F.I. points, or 26.6 per cent. The medians in May and January were 78.9 and 99.9.

The girls' records show, for 133 pupils, an average increase of 13.4 P.F.I. points or 19 per cent. The medians were 70.8 and 84.2.

It is significant that pupils whose P.F.I.'s were lowest improved least, though most of them were physiologically capable of improving most. Only 7 of 161 boys, and 1 of 133 girls showed any appreciable loss of fitness. Over 20 boys and 20 girls showed gains of over 50 per cent in physical fitness during the term.

Footprint Records.—Measurement of foot conditions is still in the experimental stage. Consequently all data thereon must be considered of questionable reliability. The following observations may or may not be

CHART II

BOYS' PHYSICAL FITNESS INDICES

Quincy Senior High School

Individual Physical Education Classes

BOYS	30–39	40–49	P.F.I. 50	60	70	80	January 1933 90	100	110	120–129	130–139	
139–130											1	1
129–120	(1)	Quincy S. H. S.							1		3	4
119–110									4	6	3	13
109–100							2	1	2	3	4	12
99–90							1	4	3	2		10
89–80				1	1	3	10	10	4	5	1	35
79–70				2	3	5	20	10	4	3	(1)	48
69–60				3	5	7	6	2	1	1		25
59–50				1	1	2	1			(1)		6
49–40			3	1								4
39–30	1				1		(1)					3
	1	0	3	8	11	17	41	27	19	21	13	161

May 1932 — P.F.I.

significant: The boys in corrective classes whose feet were measured increased in arch-angles about 8° or 39 per cent for 75 cases. The average increase for girls was 4.1° or 21 per cent for 65 cases.

INTERPRETATIONS OF STATISTICS

Boys.—The relativity of all meaningful phenomena renders comparisons essential to the interpretation of the foregoing data. In Montclair, New Jersey, in September, 1924, and June, 1925, P.F.I. tests were given. The September median P.F.I. was, for 347 boys, 105.7. In June it was 104.1, showing a loss of 1.5 per cent during the school year. The Quincy group showed a gain of 21 points or 26 per cent from May to January. Evidently the Quincy program was far more effective in improving the physical fitness of pupils.

The relatively small improvement made by pupils with very low P.F.I.'s indicates that these individuals are serious problem cases for physical educators. Any pupils failing to improve in a program which

CHART III

GIRLS' PHYSICAL FITNESS INDICES

Quincy Senior High School

Individual Physical Education Classes

GIRLS	30–39	40–49	P.F.I. 50	60	70	80	90	January 1933 100	110	120–129	130–139	
139–130												0
129–120	(3)	Quincy S. H. S.										0
110												0
100												0
90									1			1
80						1	1					2
70					14	16	22	13	2	1		68
60			1	1	18	11	2	3				36
50			2	7	2	3	1					15
49–40		1	4	3		1		①				10
39–30			1									1
	0	1	8	11	34	32	26	17	3	1	0	133

May 1932 — P.F.I.

produces an average gain of 19–26 per cent may be considered to be problems, but those who are already most deficient and who fail to improve offer the most challenging opportunities to teachers.

The fact that several pupils with high P.F.I.'s increased their fitness even further (while taking exercises primarily to improve foot and posture defects) indicates that the human machine is capable of improvement in efficiency far beyond the layman's present conception. It is not unlikely that P.F.I.'s of 150 to 200 are possible, even for many who, today, loaf along with one-third to one-fourth the physical power they might possess. Whether such high P.F.I.'s are proper is a question which cannot be answered here or from the data at hand.

Girls.—The average gain of 19 per cent for the girls was one of the most surprising revelations of the statistical summary, because of the handicaps under which their program labored. It is especially remarkable that but one girl definitely declined in fitness during the term. Under ordinary circumstances, that is, before the present program was instituted, at least 40 girls would have declined in fitness. The relatively large gains made by many girls indicate the possibility of great improvement in fitness for most girls in high schools today. The considerable increases in arch-angles indicate that foot conditions may, in a great majority of cases, be improved.

Boys and Girls.—The greater increases for boys may be due to many causes. Better facilities for boys' work probably is the greatest single factor.

STATEMENTS BY PUPILS, TEACHERS, AND OTHERS

Pupils.—Studies of individual cases provide especially interesting information. Pupils whose P.F.I.'s increased 30, 40, and 50 per cent reveal a new interest in living. They appear more cooperative and otherwise more effective socially. Disciplinary problems are practically nonexistent. Pupils who grumbled in September over the 4-day-per-week requirement now are thankful for its benefits. The typical response of girls who had improved greatly in P.F.I. was, "I feel more like *doing* things!"

Teachers.—The boys' instructor in charge of corrective classes confessed to a complete change of opinion after the first term's experience with the measurement-classification-individual needs program. At first frankly skeptical, he has become convinced of its merits. It has "revolutionized" the attitudes of many boys towards physical education.

The teacher in charge of girls' classes reports that "the results of the tests are very gratifying to me," for "both teacher and pupils are now working together toward a purposeful goal: healthier, happier individuals living a fuller and better adjusted life."

Supervisor of Physical Education.—The supervisor of physical education reports that "the personal appearance and conduct of pupils in corrective classes improved markedly. . . The morale of the entire de-

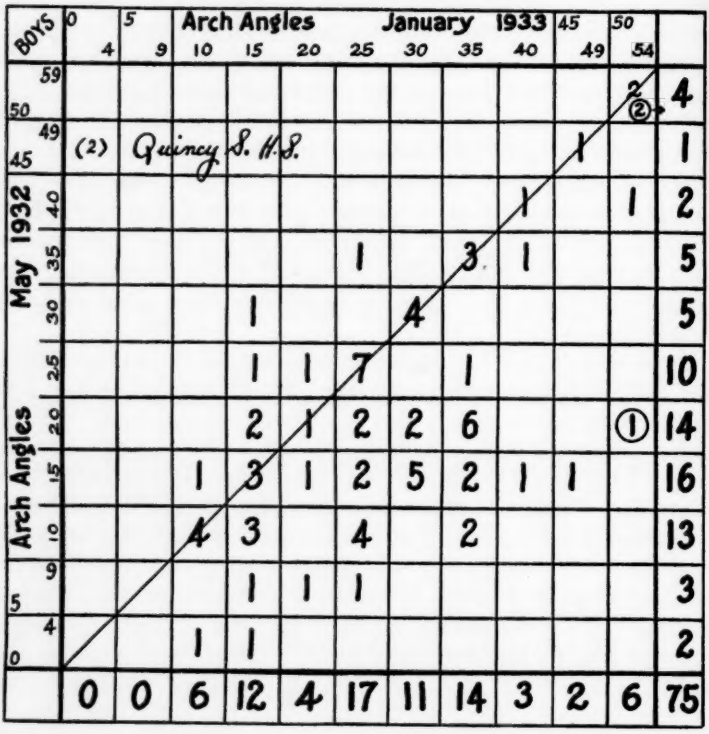
partment was lifted. . . Class organization improved. . . Medical examinations were more carefully given. . . P.F.I. increases were larger than expected. . . Improvement in social efficiency was remarkable. The outstanding event was the individual conference. . . A surprise and pleasure to have so few objections by parents and pupils. . . Augurs well for the future. . ."

CHART IV

BOYS' ARCH ANGLES

Quincy Senior High School

Individual Physical Education Classes



Arch Angles	0–4	5–9	10	15	20	25	30	35	40	45–49	50–54	
50–59											2 (2)	4
45–49	(2)									1		1
40									1		1	2
35						1		3	1			5
30				1			4					5
25				1	1	7		1				10
20				2	1	2	2	6			(1)	14
15			1	3	1	2	5	2	1	1		16
10			4	3		4		2				13
5–9				1	1	1						3
0–4			1	1								2
	0	0	6	12	4	17	11	14	3	2	6	75

Surveyor.—In the surveyor's opinion, an outstanding result of the new program at Quincy was the improvement in social efficiency of pupils and staff. Concerning the pupils, no teacher or other commentator failed to remark on their improved spirit of cooperation. To various individuals it was apparent that pupils had gained in courage, perseverance, and initiative. Certainly pupils were more "healthfully concerned" for their own health and efficiency. Concerning the staff, only those who witnessed the growth in *esprit* can appreciate the gains in this field. Individual teachers became better understood by pupils. Instructors cooperated among themselves more harmoniously and effectively. Instructors, dean

of girls, school physician, principal, and director became a unit working toward a common goal, when formerly they were independent workers hoping for the approach of diverse goals. These were not ultimate objectives of the program. But their achievement was necessary to the improvement of pupils' physical fitness; therefore, the achievements came!

The most broadly significant effect of the corrective program was the increase in vitality of pupils. It must be noted that superintendents of schools, principals, and even physical educators lacking intimate knowledge and experience in physical fitness testing can form no true conception of the significance of P.F.I. increases of 50 per cent. Individuals so changed are like different persons. Their skins clear, their eyes sparkle, their posture becomes more erect, their mental alertness increases. Time after time individuals whose P.F.I.'s had increased over 50 per cent replied to the question, "*How* do you feel different?" by the declaration noted above, to wit, that they "felt more like *doing* things." Now, "doing things" is living—doing more things is living more. It must be granted, then, that the Quincy Senior High School physical educators, in their corrective classes, have performed a signal service, for their pupils are now eager to "live more abundantly."

RECOMMENDATIONS

Several recommendations are proposed further to improve the effectiveness of special classes for physical development in the Senior High School. The most important of these are the following:

a) Methods of conducting special classes should be reviewed by physical educators and others in special meetings with the purpose of exchanging opinions, determining the most effective procedures and planning programs for the future.

b) Facilities for providing more effective programs should be arranged. These include especially cots, full-length mirrors, sponge-rubber mats, plinths, and more secluded or quiet rooms for girls' corrective activities.

c) Pupils whose P.F.I.'s on retests are above 95 should be "graduated" from the special 4-day-per-week program for the second semester.

d) More determined efforts should be made to raise the fitness of pupils who remain in the special classes.

Though the results speak for themselves, this summary would not be complete without a formal statement concerning the spirit of cooperation and general effectiveness of all who participated in the testing and corrective programs, counseling, and criticism of procedures. Everywhere and almost always, the prevailing attitude was one of desire to aid in the project, to avoid friction, and to discover the truth. The willingness of former skeptics to admit their change of mind is not the least wholesome sign. It augurs well for the greater success of future programs.

RECAPITULATION

Between September, 1932, and January, 1933, nearly five hundred pupils in the Quincy Senior High School, selected by various tests during the previous spring as those most in need of corrective procedures, attended special physical education classes four periods per week. The primary purposes of teachers were to improve physical vitality, correct defects, and develop pupil morale. Activities were closely supervised by trained instructors, working under some handicaps which may be removed in future classes.

Retests and statistical analyses in January revealed that these five hundred pupils, *who otherwise would have suffered an average decline of from one to five per cent in physical fitness,* actually improved an average of over 20 per cent. Many improved as much as 50 per cent. The social or moral tone of individuals and classes improved markedly. Pupils gained a new and deserved respect for, and confidence in, physical education. The *esprit* of the staff was likewise greatly advanced. These gains should be gratifying to the Quincy Superintendent of Schools and School Committee who endorsed and financed changes in policy and procedure in the physical education program of their Senior High School.

Effects of Various Physical Activities on the Physical Fitness of University Men

By Donald H. MacKenzie

INTRODUCTION

THE prime purpose and values of college and university physical activity programs are to conserve physical fitness, provide recreational relaxation which will keep bodies and minds fit and alert, maintain students in good health so they may make the best uses of collegiate training. All other aims and values are supplementary, or of secondary importance, to these.

Unfortunately, college physical educators have tended in practice to ignore these prime values of their program, while as Bobbitt[1] warned in 1918, they have exalted the vital *but secondary* values of socialization or so-called "character training."

Now, even if physical fitness is only one prime objective among many, it is incumbent upon directors of physical education—and even university presidents to—(*a*) maintain for students, opportunities to participate in those physical activities which yield the greatest health values, and (*b*) provide such supervision of these activities as will in fact yield the best results. Therefore, administrative officers must periodically (*c*) investigate the actual effects on students' physical fitness of the activities (sports, military drill, gymnastics, corrective activities, etc.) provided and the supervision maintained.

In the experience and from research of the writer it seems that these administrative functions have seldom if ever been performed, except in a very casual and subjective manner.

The guiding purposes of this study then, are three:

1. To report the results of an objective investigation of the effect on physical fitness of various physical activities for freshmen at Northeastern University during the fall and winter of 1934–1935.

2. From the findings thereof, to draw conclusions and make recommendations leading to: (*a*) the improvement of supervision in activities continued, (*b*) the extension of facilities for the most productive activities, (*c*) a background of facts which will guide student advisers and students in selecting activities for future development.

3. To stimulate college and university directors of physical education elsewhere to conduct similar studies, to the end that the most pro-

[1] Franklin Bobbitt.

ductive activities and the most efficient methods of supervision and instruction will be incorporated in every institution of higher learning.

From another point of view the study derives special significance. During the past few years considerable discussion has taken place among educators regarding the value of physical education courses for college freshmen. Some observers assert, without any objective proof whatsoever, that these courses are "very beneficial" to the students while others claim that, *as the courses are set up at the present time*, there is very little value derived from them. These claims, too, are largely unsubstantiated. The recent report of the Carnegie Foundation,[2] however, which indicates that the general cultural content of college seniors is no higher than that of freshmen, might easily be paralleled in lack of physical improvement as students prepare themselves for degrees and life work! College administrators ought to know the facts.

It was with these aims in mind that the research reported here was undertaken.

PROCEDURE

Various methods of measuring physical condition and changes that take place in condition from time to time are available. The method used in this research was Physical Fitness Index testing, and analysis of test results "before and after" activity programs were followed. Freshmen were measured by this test at the beginning, at the middle, and at the end of the course. The changes that took place between tests were used as the measure of improvement or decline in the student's general health. The validity of P.F.I. technic has been well established over a period of ten years' experimenting and practical application on hundreds of thousands of school boys, girls, and men. Its application to the college level was the subject of G. N. Messer's doctor's dissertation.[3]

After being tested the students selected activities according to their preferences and with the counsel of university officers. They remained in these activities, participating from two to five periods weekly, for ten weeks, when they were retested. They then chose new activities (or continued in the same ones) for another ten-week period, after which they were given a third test. The test results were then analyzed.

In detail, procedures were as follows:

1. All freshmen at Northeastern University are required to undergo a thorough medical examination upon entering school. They are not allowed to participate in any physical activities until this has been done.

2. Physicians were requested to examine each student and note any defects or condition which should bar the students from taking the strength tests. Conditions deemed sufficiently serious to restrict students from taking tests are as follows:

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[2] B. D. Wood.

[3] G. N. Messer, Critical Analysis of the Application of the Rogers Physical Fitness Test to Williams College Students. New York University, 1932.

heart trouble, hernia, rupture, recent appendix scars, and any other serious and recent illness.

3. If the examining physician felt that the student's condition was satisfactory, he then took the seven tests which comprise the strength test battery.

4. If, on the other hand, the physician felt that the student's health was such that it would be unwise for him to take strength tests he was restrained until such time as the doctor felt his condition had improved sufficiently to remove any element of danger to the student.

5. P.F.I. tests were given at the gymnasium of Northeastern University on September 7 and 8, 1934. They were repeated again on November 19 and 20, 1934, and also on January 28, and 29, 1935.

6. At Northeastern University all freshmen are required to complete a twenty-week physical education course. Students select the particular activity in which they wish to participate. There are eight options in each ten-week period as follows:

First Half	*Second Half*
September 7 to November 19	November 20 to January 28
Abdominal Class	Abdominal Class
Low Physical Fitness	Low Physical Fitness
Gym Class	Gym Class
Swimming Class	Swimming Class
Wrestling Class	Wrestling Class
Track	Track
Cross-Country	Hockey
Football	Basketball

7. At the close of each period a list of participants was obtained from each coach and instructor for his activity. These lists were used in determining the P.F.I.'s of each group.

GENERAL RESULTS

FIRST PERIOD

The general results of the first ten-week period are reported in detail in Table I involving 282 men who were tested and retested. P.F.I. changes are pictured graphically in Chart 1. It is important to note first the high average P.F.I. of the entire group: 106.2. This average practically guarantees the existence of two conditions; first, that tests were efficiently administered, and second, that the general fitness of the Northeastern freshmen is phenomenally high. Averages elsewhere range from 90 to 98. Readers familiar with P.F.I. technic and average scores of high school seniors and college men will recognize the importance as well as significance of this high beginning average.

Though the numbers of students in some groups were small, certain definite trends seem clearly evident. A few of these are noted below:

1. The average P.F.I. for the entire group rose from 106.2 to 111.6. This increase was quite unexpected—it may even be accurately described as remarkable, considering that the tendency of average students in the average physical education and academic program in grades 9 through 16 is to lose in P.F.I. during the fall and winter months. But these Northeastern students were already far above the average, due to heavy summer working programs. To improve further is not only

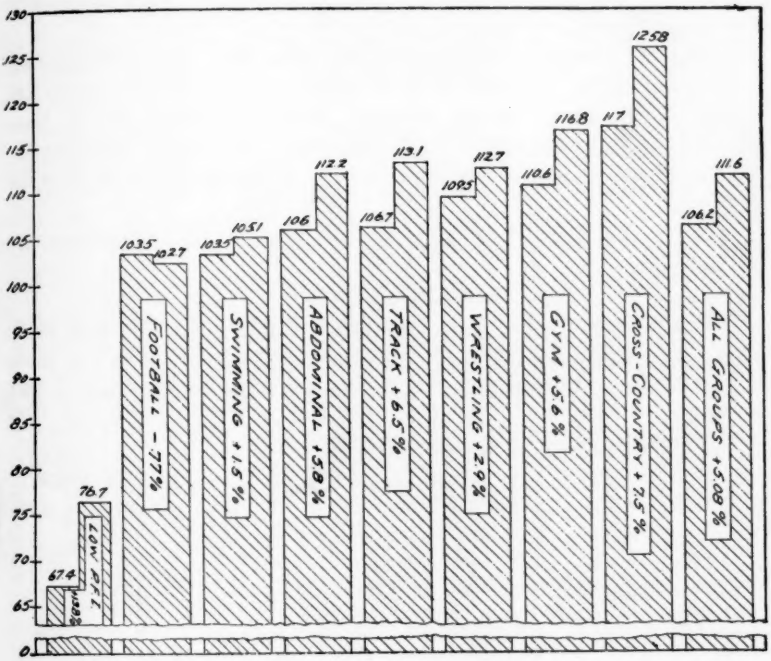
TABLE I

MASTER CHART SEPT.—NOV. P.F.I. DATA

		Age	Weight	Height	Arm	Leg	Back	Left	Right	Lung	S.I.	N.S.I.	P.F.I.
Abdominal	Sept. Ave.	18–11	144.1	67.9	340.	750.	459.	98.1	110.0	262.	2014.	1937.	106.
	Nov. Ave.	19–1	146.3	68.3	374.	787.	533.	102.6	115.8	271.	2184.	1977.	112.2
21 Cases	Change	2	2.2	.4	34.	37.	74.	4.5	5.8	9.	170.	40.	6.2
Low P.F.I.	Sept. Ave.	18–4	169.7	68.7	120.	656.	408.	95.1	101.7	259.	1607.	2384.	67.4
	Nov. Ave.	18–6	172.0	69.1	197.	748.	482.	96.4	110.0	256.	1850.	2466.	76.7
11 Cases	Change	2	2.3	.4	77.	92.	74.	.7	8.3	—3.	243.	82.	9.3
Gym	Sept. Ave.	18–7	137.1	68.0	367.	676.	444.	94.5	105.6	261.	1950.	1780.	110.6
	Nov. Ave.	18–9	139.0	68.3	387.	737.	493.	100.8	109.5	263.	2100.	1820.	116.8
97 Cases	Change	2	1.9	.3	20.	61.	49.	6.3	3.9	2.	150.	40.	6.2
Swimming	Sept. Ave.	18–8	140.1	68.6	259.	680.	445.	91.	103.3	259.	1846.	1844.	103.5
	Nov. Ave.	18–10	141.7	68.8	319.	682.	479.	93.5	107.8	255.	1930.	1886.	105.1
30 Cases	Change	2	1.6	.2	60.	2.	34.	2.5	4.5	—4.	84.	42.	1.6
Wrestling	Sept. Ave.	18–9	142.6	67.6	357.	750.	453.	100.9	113.4	264.	2038.	1907.	109.5
	Nov. Ave.	18–11	144.8	68.1	390.	774.	491.	109.6	120.3	267.	2154.	1946.	112.7
8 Cases	Change	2	2.2	.5	33.	24.	38.	8.7	6.9	3.	116.	39.	3.2
Track	Sept. Ave.	18–8	145.6	68.8	385.	736.	453.	103.2	109.5	274.5	2065.	2014.	106.1
	Nov. Ave.	18–10	147.2	69.1	422.	803.	517.	105.1	115.1	272.5	2241.	2056.	113.0
74 Cases	Change	2	1.6	.3	37.	67.	64.	1.9	5.6	—2.	176.	42.	6.9
Cross Country	Sept. Ave.	18–6	135.	66.8	400.	701.	460.	94.3	109.6	255.2	2021.	1731.	117.
	Nov. Ave.	18–8	136.9	67.1	392.5	812.8	540.	98.1	110.9	251.2	2196.	1773.	125.8
14 Cases	Change	2	1.9	.3	—7.5	111.8	80.	3.8	1.3	—4.	175.	42.	8.8
Football	Sept. Ave.	18–4	151.6	68.9	457.	759.	503.	106.0	117.7	288.	2229.	2187.	103.5
	Nov. Ave.	18–6	155.6	69.2	401.	840.	547.	110.7	117.6	280.	2296.	2269.	102.7
27 Cases	Change	2	5.0	.3	—56.	81.	44.	4.7	—.1	—8.	67.	82.	—.8
All Groups	Sept. Ave.	18–7½	142.9	68.3	359.	708.	453.	98.0	108.2	267.	1986.	1924.	106.2
	Nov. Ave.	18–9½	144.9	68.6	383.	767.	508.	102.2	112.4	266.	2141.	1970.	111.6
282 Cases	Change	2	2.	.3	24.	59.	55.	4.2	4.2	—1.	155.	46.	5.4

excellent evidence of the character of their physical education and academic programs but also a *new proof that college students as a rule do not even remotely approach their potentialities for work and study.*[4]

2. The "low P.F.I." group had the greatest gain. This might be expected, for these men were furthest removed from their potentialities.



1ST PERIOD - P.F.I CHANGES
CHART I

However, those familiar with the physical and temperamental nature of low P.F.I. men know that these often are the most difficult cases to "treat."

3. The football group had the least gain—it was, indeed, a loss. When the activity was analyzed this loss explained itself.

4. Swimming and wrestling, two normally violent or all-round activities, had small gains. These results were surprising but easily explained when investigated.

5. The cross country group had the highest beginning average, namely, 117. They had the second greatest gain, as their P.F.I. in November was 125.8.

6. The abdominal and gym classes both had a P.F.I. gain of 6.2 although they had different starting averages.

[4] In connection see Giauque's comment on page 269.

At this point the reader must have asked himself the questions, "But how were these activities conducted? Were facilities ample? Were classes large or small? Were instructors attentive or careless? Was the program well organized or not? What were actual teaching technics in each case? Did students in, say, football, lose strength in all parts of the body or only in some parts? What parts? How about changes in other activities?"

These are perfectly proper questions. The first great contribution of the study is to demonstrate how concentratedly the questions are focused by the measurement program. They had never before been raised at Northeastern University, except in a perfunctory and routine way, for it was known in advance that no authoritative answers could be given.

Later in this study brief attention is given to these questions for each activity.

SECOND PERIOD

At the close of the first period students relaxed for a few days, after which they selected activities for the second period. Of these 228 cases were retested in January. General results are reported in Table II and Chart 2.

Brief comments on results are given below:

1. The continued rise in P.F.I. from the high average of 106.2 in September to 111.6 in November to 117.1 in January serves to confirm many tentative observations made above:

a) Testing must have been efficient throughout.

b) The high P.F.I. in September was not erroneous or accidental.

c) The Northeastern physical education and academic program is extraordinarily efficient when judged according to its effects on general health, physical fitness, capacity for activity or "life more abundantly."

d) College students generally throughout the nation whose P.F.I.'s drop from year to year probably (1) loaf unnecessarily, or (2) overstudy, thus straining themselves physically.

2. The hockey squad had the greatest gain. This gain was 8 points from 117.3 to 125.3 which was the third highest average P.F.I. obtained by any group in either period.

3. The "low P.F.I." group increased 5.9 points to an average of 79.3 in January. This gain was a drop of 3.4 from the gain registered in the first period by this same group.

4. The gym group increased 6.2 points. This is exactly the same gain that was made in the first period by the gym group.

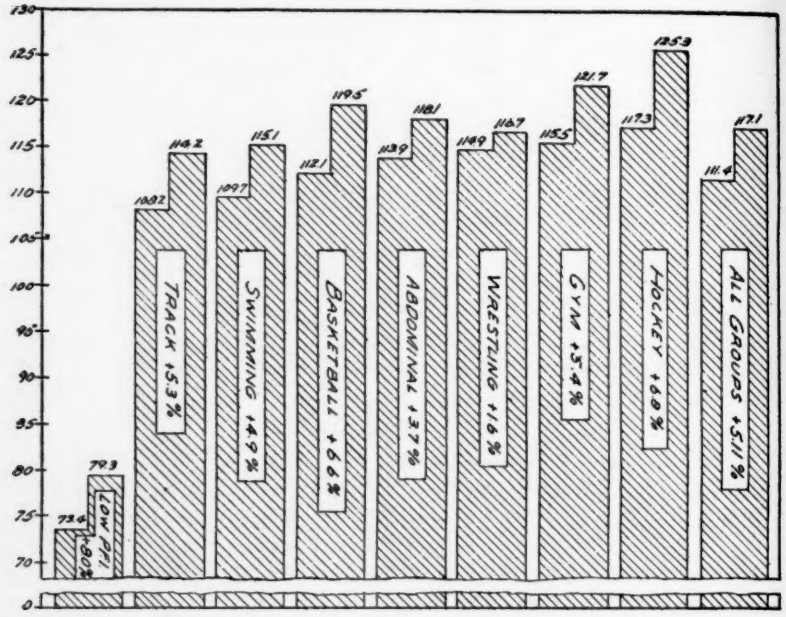
5. Wrestlers showed the least gain. They had an increase of only 1.8 points. This is very small when one considers the amount of activity that is normally associated with this sport, but when one checks the conditions of the activity as conducted at Northeastern the reason becomes evident.

TABLE II
MASTER CHART NOV.—JAN. P.F.I. DATA

		Age	Weight	Height	Arm	Leg	Back	Left	Right	Lung	S.I.	N.S.I.	P.F.I.
Abdominal	Nov. Ave.	19–9½	146.3	68.7	403.5	795.	529.7	102.3	114.7	273.7	2218.9	1983.8	113.9
	Jan. Ave.	19–11½	146.9	68.9	433.3	842.7	548.3	103.1	118.9	270.9	2310.5	2002.6	118.1
15 Cases	Change	2	.6	.2	29.8	47.7	18.6	.8	4.2	—2.8	91.6	18.8	4.2
Low P.F.I.	Nov. Ave.	18–4½	173.7	69.1	165.8	675.6	480.	95.5	110.8	249.8	1784.9	2493.6	73.4
	Jan. Ave.	18–6½	171.4	69.3	189.6	772.5	490.1	103.8	105.5	256.	1918.	2480.8	79.3
8 Cases	Change	2	—2.3	.2	23.8	97.1	10.1	8.3	—5.3	6.2	133.1	—12.8	5.9
Gym	Nov. Ave.	18–8	140.6	68.2	391.	741.7	492.5	99.7	108.5	265.7	2099.3	1845.9	115.5
	Jan. Ave.	18–10	141.2	68.3	419.	808.3	534.1	104.6	114.1	264.0	2242.7	1867.4	121.7
108 Cases	Change	2	.6	.1	28.	66.6	41.6	4.9	5.6	—1.7	153.4	21.5	6.2
Swimming	Nov. Ave.	18–9	140.8	68.0	321.2	698.1	481.7	90.9	106.4	254.6	1958.7	1855.8	109.7
	Jan. Ave.	18–11	141.5	68.2	344.3	764.1	511.7	102.3	110.3	251.5	2090.7	1878.6	115.1
24 Cases	Change	2	.7	.2	23.1	66.0	30.0	11.4	3.9	—3.1	132.0	22.8	5.4
Wrestling	Nov. Ave.	18–11½	151.0	68.7	477.5	839.1	520.0	108.3	120.3	281.9	2347.	2069.1	114.9
	Jan. Ave.	19–1½	151.9	68.8	477.6	865.	584.1	114.5	122.5	278.6	2442.4	2100.1	116.7
11 Cases	Change	2	.9	.1	.1	25.9	64.1	6.2	2.2	—3.3	95.4	31.0	1.8
Track	Nov. Ave.	18–10	148.7	69.7	389.6	707.3	506.4	103.1	115.6	277.5	2189.4	2077.4	108.2
	Jan. Ave.	19–0	152.1	69.8	416.5	853.7	560.0	108.9	122.4	280.7	2342.1	2096.7	114.2
34 Cases	Change	2	3.4	.1	26.9	146.4	53.6	5.8	6.8	3.2	152.7	19.3	6.0
Hockey	Nov. Ave.	18–2	136.3	68.7	422.	760.	521.7	102.	111.6	246.6	2162.	1741.	117.3
	Jan. Ave.	18–4	136.7	69.3	448.6	800.	573.3	102.	120.	242.	2286.	1755.	125.3
13 Cases	Change	2	.4	.6	26.6	40.	51.6	0.	8.4	—4.6	124.	15.	8.0
Basketball	Nov. Ave.	18–6	144.7	68.6	369.1	794.7	497.3	103.9	112.7	273.1	2150.8	1925.4	112.1
	Jan. Ave.	18–8	145.1	68.7	411.2	845.5	561.0	107.5	116.8	270.4	2312.4	1939.6	119.5
15 Cases	Change	2	.4	.1	42.1	50.8	63.7	3.6	4.1	—2.7	161.6	14.2	7.4
All Groups	Nov. Ave.	18–9	144.8	68.6	377.3	756.9	498.5	100.0	111.2	267.5	2112.4	1940.4	111.4
	Jan. Ave.	18–11	145.8	68.7	403.6	817.5	540.4	105.7	115.9	266.6	2249.1	1965.4	117.1
228 Cases	Change	2	1.0	.1	26.3	60.6	41.9	5.7	4.7	—.9	136.7	25.0	5.7

6. Swimming showed a gain of 5.4 points or three and a half times the first period gain. This was caused by a change in the type of activity participated in by the students.

7. The basketball squad had a gain of 7.4 points. This is contrary to several other researches which have been read by the writer but the reasons will be brought forth later in this study.



2ND PERIOD - PF.I CHANGES
CHART II

BRIEF ANALYSIS OF ACTIVITIES

Abdominal Group

1. This group consisted of students detected by physicians as "having trouble" in "abdominal regions." The most pronounced troubles were protruding abdomens, relaxed abdominal muscles, and post-operative cases.

2. Facilities were ample including a large gymnasium floor, stall bars, parallel bars, horses, and bucks.

3. The program was organized in great detail and on paper at meetings of the physical education staff. The main purpose of the program was to help the students regain control of the muscles of the abdominal region.

4. The group met twice weekly for forty-five-minute periods. Most of the exercises were taken lying on the floor, though considerable apparatus work was included. The group was active most of each period.

5. Changes in each test are reported in Tables I and II. The most outstanding change was in the back lift which increased 74 points in the first period.

6. The reason for the change is possibly that the type of exercises given were very conducive to improvement of the muscles of the back.

7. The most outstanding "difference in change" between periods was in lung capacity which increased 9 points in the first period and lost 2.8 points in the second period.

Low Physical Fitness Group

1. This group consisted of students who had a Physical Fitness Index of 80 or below in the September test.

2. Facilities were ample including a large gymnasium floor, stall bars, parallel bars, horses, and bucks.

3. The pupils had a personal interview with the physical education staff at which time each student had his medical card and his strength test card checked over, and was questioned as to the reason for his low strength score. After this conference an individual program was prepared for each boy who was then called in for a second conference.

4. The group met twice weekly for forty-five-minute periods. The exercises were varied to meet the individual conditions. Some were taken on the floor, some on apparatus and some standing, but all were under the supervision of an instructor.

5. The changes in each test are reported in Tables I and II. The most outstanding change was in the leg lift. There was an increase of 92 points in the first period and 97.1 in the second period.

6. The reason for the change is possibly that the type of exercise given was not favorable to improvement of the muscles of the legs.

7. The most outstanding "difference in changes" between periods was in the back lift with a first period change of 74 and a second period change of 10.1.

Gym Class

1. This group consisted of all students who had not selected or were not assigned to any other activity.

2. The facilities consisted of a large gymnasium one hundred feet in length and fifty feet in width. There were stall bars on one side of this gym. There was a net which could be strung across the floor making two gyms.

3. The program was planned by the physical education staff and consisted of calisthenics of the usual type and games.

4. The group met twice a week for forty-five-minute periods. The first fifteen minutes were given over to exercises and the balance of the time was used for games. Due to the size of the class no apparatus work was given.

5. Changes in each test are reported in Tables I and II. The most outstanding thing about this group is that the changes are very nearly the same as the average for all groups. There were no outstanding changes in individual tests.

6. The most outstanding "difference in changes" between periods was the fact that the P.F.I. increase for both periods was exactly the same, namely 6.2.

Swimming Class

1. This group consisted of students who were unable to pass the swimming test which is given to all entering freshmen at Northeastern University.

2. The swimming pool is twenty-five feet wide and seventy-five feet long. The depth varies from two feet at one end to nine feet near the other end.

3. The program was organized by the swimming instructor. The most important item in the program was to overcome the students' "fear of the water." This was accomplished by gradually allowing the students to try to swim.

4. The group met twice weekly for forty-five-minute periods. The students first practiced the strokes on benches. Then they hung on to the edge of the pool and practiced the kicks. Later they stood in the pool and bent over to practice the arm strokes. When they learned these strokes they were allowed to try to actually swim.

5. Changes in each test are reported in Tables I and II. The most outstanding change was in the leg lift. The increase was only 2 points in the first period as against an increase of 66 points in the second period.

6. The reason for the change is possibly that the practice of the kick was not intensive enough in the first period when the time was divided between arm stroke and the kick.

7. The most outstanding "difference in changes" between periods was in the P.F.I. The increase was 1.6 in the first period and 5.4 in the second period.

Wrestling Group

1. This group consisted of those students who desired to learn how to wrestle. It was an option open to all freshmen.

2. The facilities were a room about fifteen by twenty feet, the floor of which was covered with mats.

3. The instructor, an expert wrestler, planned his program so that the boys would learn the fundamentals of wrestling, as well as have some actual competition.

4. The group met twice weekly for forty-five-minute periods. They practiced making and breaking holds on each other during the first test period. During the second test period they had actual wrestling matches among themselves but as the facilities were inadequate they did not have much more than ten minutes exercise a day. The balance of the time was spent watching the others wrestle.

5. Changes in each test are reported in Tables I and II. The most outstanding change was in the back lift. This increased 64.1 points in the second period as against 38 points in the first period.

6. The reason for the change is possibly that the constant use of the wrestlers' bridge did much to increase the strength of the back muscles.

7. The most outstanding "difference in changes" between periods was in the arm strength where a first period increase of 33 points was recorded against a second period increase of .1 points.

Track Squad

1. This group consisted of students who desired to participate in track and who had been deemed sufficiently capable by the track coaches.

2. The facilities available included a twelve-laps-to-the-mile indoor track, a twelve-lap outdoor board track, and outdoor jumping pit, and a large gymnasium floor on which were practiced the dashes, hurdles, and shot-puts.

3. The program was under the direction of three coaches, one of whom had charge of the field event men. They planned their program so that each student received individual attention every day.

4. The group met four times weekly for one hour periods. The student practiced on his specialty and did whatever other exercise the coaches thought would be useful.

5. Changes in each test are reported in Tables I and II. The most outstanding change was in the leg lift where an increase of 67 points was registered in the first period and 146.4 points in the second period.

6. The reason for the change is probably that the constant running indulged in by this squad greatly increased the strength of the leg muscles.

7. The most outstanding "difference in changes" between periods was in the leg lift. The first period change was 67 compared to a second period change of 146.4.

Cross-Country

1. This group consisted of those men interested in the running of a cross-country course. They were not cut by the coach but a selection was made each week of the seven best men for each intercollegiate race.

2. The facilities available were a five-lap-to-the-mile cinder track, twelve-lap-

to-the-mile board track, and a five-mile cross-country course so mapped out that any mileage from one to five could be accurately measured.

3. The program was organized by the coach in detail and with the training of the students in mind.

4. The group met twice weekly for ninety-minute periods. The first portion of each period was devoted to setting up exercises after which the students ran either on the track or over the cross-country course.

5. Changes in each period are reported in Table I. The most outstanding change occurred in the leg lift and the P.F.I. The leg lift increased 111.8 points while the P.F.I. increased 8.8 points.

6. The reason for the change is apparently due to the exercise that the boys had in practice and in the meets. Constant exercise of the legs seems to improve the strength of the leg muscles.

Football Squad

1. This group consisted of those members of the freshman class that had been selected by the freshman coaches as sufficiently qualified to represent the University in intercollegiate competition.

2. The facilities available included a regulation football field, an extra practice field, equipment of the most modern kind and in sufficient amounts to take care of all the students.

3. The program was organized by the three coaches so that the boys would have the fundamentals of football as well as a number of plays learned when the intercollegiate schedule started on October 7, 1934. The schedule consisted of six games, five of which were won and the other tied.

4. The group met five days weekly for ninety-minute periods. The practice consisted of setting up exercises, fundamental exercises in football, such as tackling and blocking, dummy scrimmages, and actual scrimmages.

5. Changes in each test are reported in Table I. The most outstanding change was in the P.F.I. which decreased .8 points during the first period.

6. The reasons for the changes are possibly that (*a*) the students had too much exercise, (*b*) an increase in weight resulted in an increased norm, (*c*) the players may have been stale when tested, which was three days following the final game, (*d*) as football had the only circled scores it is possible that some of the cases studied should have been circled scores and, therefore, not counted in this report, (*e*) the players practiced between twelve and two so that they played on either a full stomach or an empty stomach.

Hockey Squad

1. This group consisted of students who desired to participate in hockey and who had been deemed sufficiently capable by the coach.

2. The facility available was the hockey rink of the Boston Arena.

3. The program was designed to develop ability to skate and to teach the fundamentals of hockey.

4. The group met twice weekly for ninety-minute periods. The practice was divided between teaching the boys how to skate, how to handle a hockey stick, and the fundamentals of hockey.

5. Changes in each test are reported in Table II. The most outstanding change was the fact that the left grip was unchanged while the right grip increased 8.4 points.

6. The reason for the changes is possibly the method of handling the stick. The left hand is used to guide the stick while the right hand is the driving force in using the stick.

Basketball Squad

1. This group consisted of students who desired to participate in basketball and who had been deemed sufficiently capable by the coach.

2. The facilities available were three gyms, one, one hundred by fifty and the other two, sixty by thirty-five. There was a total of eleven baskets available for practice shooting.

3. The program was designed to develop in the boys an eye for shooting as well as to teach the fundamentals of basketball.

4. The group met four days weekly for sixty-minute periods. They practiced the fundamentals of passing, dribbling, pivoting, and shooting. They also had scrimmages twice a week.

5. Changes in each test are reported in Table II. The most outstanding change was in the arm strength where an increase of 42.1 points was recorded.

6. The reason for the change is possibly that the constant shooting develops the muscles of the arms and back.

SPECIAL CASES

Twelve case reports are included to illustrate special findings which result from measurements, as well as to indicate the general nature of guidance given by the test results.

Track Group. (H. P.)—P.F.I.'s 109, 129, and 148. This boy weighed 128 pounds in September and remained about the same for the course. His gains were due to a general increase in fitness as his Strength Indices were 1756, 2070, and 2381 while his N.S.I. remained the same.

Abdominal Group. (H. C.)—P.F.I.'s 78, 94, and 101. The boy weighed 162, 165½, and 166. His Strength Indices were 1834, 2281, 2453. The increase in P.F.I. was due to a marked gain in strength as his norm also increased.

Track Group. (W. B.)—P.F.I.'s were 142, 162, and 175. The boy was 17½ years old, weighed 117 pounds, and was 66.5 inches tall. The change in P.F.I. was due to a general all-round physical improvement as his norm remained constant.

Wrestling Group. (C. G.)—P.F.I.'s 96, 116, and 131. This was due to an improvement in the leg lift which went from 735 to 1110 and then to 1310.

(B. P.)—P.F.I.'s recorded for this student were 74, 91, and 128. This was due to the special exercises given by the physical director and to a drop in weight of 10 pounds.

(M. C.)—This boy was placed in the low P.F.I. group by the physical director as he had a P.F.I. of 79 in September. This increased to 107 in November and 129 in January due to strength increase as his norm was about the same for all tests.

(R. B.)—September P.F.I. of 78 was regarded as very low for this student. Questioning by the tester revealed that student had been ill for two months with streptococcus infection. Placed in low P.F.I. group and given special exercise. In November P.F.I. was 101. Student left school before January so a third test was not taken.

(E. F.)—The P.F.I. in September was 61. Boy's weight was 226. Placed in special exercise group and although strength had increased by November his P.F.I. had dropped to 55 due to a 9-pound increase in weight. By very close check on student both in and out of school his P.F.I. in January was 67 with a 4-pound decrease in weight.

(J. D.)—In September when being tested for the leg lift this student broke the handle of the back and leg dynamometer with a lift of 1290. His P.F.I.'s were 141–141–130. The last P.F.I. was low due to a sore back as his leg lift went down to 1060.

(G. M.)—The P.F.I.'s for this student were 165–136–161. The low second

score was caused by a bad cold of which the boy complained. He had been sick with it for two weeks.

(F. C.)—A P.F.I. increase from 132 to 159 to 173 was recorded by this boy. This was due to a straight increase in strength as his norm was practically the same for all tests.

(A. P.)—In September a P.F.I. of 47 was recorded for this boy. A careful check-up by the physical education staff revealed that the boy was over-worked and did not have sufficient rest. As a result of the reorganization of daily life his P.F.I. went to 63 in November and 89 in January.

SUMMARY

Comparisons of P.F.I. changes in Northeastern University students in various activities indicate that wide differences in physical fitness are effected by participation in different sports. The data seem to show that *as conducted at Northeastern during September, 1934, to January, 1935,* general corrective programs, exercises to improve abdominal conditions, cross-country, and hockey yielded the greatest dividends in physical development. Football was least productive, but wrestling was not much better.

Comparisons between the two periods seemed to verify the writer's observation during the first period that increase in fitness depends less on the nature of the sport than on the methods used by instructors and supervisors in controlling students' activities. It is, for example, possible to make football much more productive than at present, by changing practice technics, particularly the hour of practice.

What results would occur if supervision were withdrawn from all sports remains an interesting and challenging question to be solved by further research.

It should be noted that this study did not pretend to measure changes in attitudes. Thus the swimming instructor spent nearly six weeks in overcoming his students' "fear of the water." This accomplished, though no great gains in physical fitness were effected, he then set them to swimming, and during the second period their P.F.I. gain was very creditable. Since all athletic abilities depend on considerable strength for adequate performance it would seem wise if the swimming instructor took whatever steps were necessary to increase strength during the first period as well as the second.

The testing and research programs had markedly good effects on many coaches, instructors, physicians, and directors. Knowing that their work would be checked they examined students more carefully, followed up examinations more persistently, and were more active in leading special groups.

The effects on students were remarkable. Not only was fitness greatly improved but also the students' attitudes changed considerably. The students asked many questions as to how they could improve their physical condition. Several "low Physical Fitness" students reported

that they felt much better physically and that they had more pep as their P.F.I. improved. All the students cooperated to the best of their ability with the testers and with their coach or instructor during the twenty weeks of the course.

The tests were the first ever given at Northeastern University. It is the feeling of the physical education staff that the value received was so great that they should have a fixed place in the physical education program.

STATISTICAL ANALYSIS

Tables III and V report the weighted average changes in test scores between September and November and the medians and correlation data. Tables IV and VI report the same data for November-January changes. These data are recorded to facilitate comparisons between activities. The following tentative conclusions are suggested which, of of course, must be verified by other investigations before being at all useful for final conclusions:

1. The high correlations between tests for the abdominal group (.89) together with the increase in P.F.I. of 6.2 would seem to indicate that improvement was fairly uniform for most of this group.

2. In the wrestling group, although the P.F.I. increase was only 3.2 the sigma decreased 2.35 points from 15.80 to 13.45, indicating that the group was more homogeneous in November than in September. While the increase was small yet all the students tended to change alike. The correlation coefficient between tests was .89.

3. Cross-country seems to be the best sport for all-round physical development. This is shown by an increase in strength of 175 pounds. The leg lift increased 111.8 points while the back lift increased 80.0 points. The P.F.I. change was plus 8.8. The correlation coefficient of .80 between tests indicates that the changes were spread over the entire group rather than a few cases having exceptional gains.

4. Football showed a P.F.I. decrease of .8 points. The sigma change was minus 3.80 from 18.50 to 14.70. This would seem to indicate that while there was a slight decrease in fitness the group tended to be more homogeneous at the end of the period than at the beginning. It should also be noted that *the decrease was in P.F.I. and not in actual strength.* There was a gain in strength of 67 points which was, however, not sufficient to offset the norm increase of 82 points.

5. A comparison of the swimming changes between the first and second period seems to indicate that the greatest improvement came not from practicing the stroke and the kick singly in the air, but from actual experience in the water. This is indicated by a strength increase of 84 points in the first period and 132 points in the second period when swimming practice was increased.

6. In the writer's opinion the individual programs of exercise such as used in the "Low P.F.I. group" are the best type of exercise for

TABLE III

SEPTEMBER—NOVEMBER WEIGHTED AVERAGE CHANGE IN SCORES

	Abdominal	Low P.F.I.	Gym	Swimming	Wrestling	Track	Cross Country	Football	All Groups
No. of Cases	21	11	97	30	8	74	14	27	282
Age (Mo.)	2	2	2	2	2	2	2	2	2
Weight	2.2	2.3	1.9	1.6	2.2	1.6	1.9	5.0	2
Height (In.)	.4	.4	.3	.2	.5	.3	.3	.3	.3
Arm Strength	34	77	20	60	33	37	−7.5	−56	24
Leg Lift	37	92	61	2	24	67	111.8	81	59
Back Lift	74	74	49	34	38	64	80	44	55
Left Grip	4.5	.7	6.3	2.5	8.7	1.9	3.8	4.7	4.2
Right Grip	5.8	8.3	3.9	4.5	6.9	5.6	1.3	−.1	4.2
Lung capacity	9	−3	2	−4	3	−2	−4	−8	−1
Strength I.	170	243	150	84	116	176	175	67	155
Normal S. I.	40	82	40	42	39	42	42	82	46
P. F. I.	6.2	9.3	6.2	1.6	3.2	6.9	8.8	−.8	5.4

TABLE IV

NOVEMBER—JANUARY WEIGHTED AVERAGE CHANGE IN SCORES

	Abdominal	Low P.F.I.	Gym	Swimming	Wrestling	Track	Hockey	Basketball	All Groups
No. of Cases	15	8	108	24	11	34	13	15	228
Age (Mo.)	2	2	2	2	2	2	2	2	2
Weight	.6	−2.3	.6	.7	.9	3.4	.4	.4	1.0
Height (In.)	.2	.2	.1	.2	.1	.1	.6	.1	.1
Arm Strength	29.8	23.8	28	23.1	.1	26.9	26.6	42.1	26.3
Leg Lift	47.7	97.1	66.6	66	25.9	146.4	40	50.8	60.6
Back Lift	18.6	10.1	41.6	30	64.1	53.6	51.6	63.7	41.9
Left Grip	.8	8.3	4.9	11.4	6.2	5.8	0	3.6	5.7
Right Grip	4.2	−5.3	5.6	3.9	2.2	6.8	8.4	4.1	4.7
Lung Capacity	−2.8	6.2	−1.7	−3.1	−3.3	3.2	−4.6	−2.7	−.9
Strength I.	91.6	133.1	153.4	132	95.4	152.7	124	161.6	136.7
Normal S. I.	18.8	−12.8	21.5	22.8	31.0	19.3	15	14.2	25
P. F. I.	4.2	5.9	6.2	5.4	1.8	6.0	8.0	7.4	5.7

TABLE V

TABLE V

SEPTEMBER—NOVEMBER P. F. I.—CORRELATION DATA

	Abdominal	Low P.F.I.	Gym	Swimming	Wrestling	Track	Cross Country	Football	All Groups
Sept. Median ...	105.98	67.5	111.27	103.66	110.6	107.91	117.5	103.52	106.4
Nov. Median ...	112.03	78.6	117.14	105.67	112.5	113.31	126.1	103.24	112.17
Median Change .	6.05	11.1	5.87	2.01	1.9	5.40	8.6	−.28	5.77
Sept. Sigma	14.60	11.40	15.63	20.355	15.80	23.87	13.05	18.50	19.885
Nov. Sigma	17.59	14.58	16.5	18.640	13.45	24.16	16.27	14.70	20.540
Sigma Change ...	2.99	3.18	.87	−1.715	−2.35	.29	3.22	−3.80	.655
r	.89	.73	.76	.83	.89	.89	.80	.78	.82
P. E. r	.0306	.0945	.0289	.0383	.0491	.0163	.065	.0508	.0134
P. I. r	.54	.31	.35	.44	.55	.54	.40	.37	.43

TABLE VI

NOVEMBER—JANUARY P.F.I.—CORRELATION DATA

	Abdominal	Low P.F.I.	Gym	Swimming	Wrestling	Track	Hockey	Basketball	All Groups
Nov. Median	113.	73.5	115.9	110.1	115.2	109.4	116.9	112.3	111.6
Jan. Median	118.2	79.5	121.4	115.9	116.7	115.1	125.7	119.4	117.7
Median Change ..	5.2	6.0	5.5	5.8	1.5	5.7	8.8	7.1	6.1
Nov. Sigma	16.41	15.92	16.41	17.95	13.91	18.19	16.51	17.49	20.89
Jan. Sigma	18.72	18.52	17.03	16.91	12.74	19.76	18.93	15.38	22.04
Sigma Change ..	2.31	2.60	.62	−1.04	−1.17	1.57	2.42	−2.11	2.15
r	.91	.77	.77	.86	.87	.84	.80	.79	.83
P. E. r.....	.0337	.0975	.0265	.0358	.0467	.0336	.0545	.0654	.0135
P. I. r	.57	.36	.36	.49	.50	.45	.40	.38	.44

strength improvement. The average increase in strength in the first period was 243 points and in the second period 133.1 points. The total increase for the two periods was 376.1 which is about 50 points higher than track and 75 points higher than gymnastics.

7. The gymnasium group did not increase as much as they should have in arm strength. This was caused by lack of apparatus work. However, the group as a whole had a P.F.I. increase of 6.2 for each period. This fact, together with the fact that the correlation coefficient was almost the same for both periods, indicates that these students all had a steady upward rise in P.F.I. which was sustained over both periods.

8. The track squad had a marked improvement in leg lift for the second period over the increase of the first period. This seems to show that actual increase in leg strength comes more from actual competitive racing than from practice where one is not so forced as in regular competition.

RECOMMENDATIONS

The recommendations listed below are made with full realization that under present conditions at Northeastern University it will not be possible to put some of them into effect. However, they should be kept in mind so that when facilities are improved the changes can be made.

1. The wrestling group should be placed in a larger space so that there will be more opportunity for more members of the group to exercise simultaneously. The space might well be one of the small gymnasiums, suitably equipped with mats.

2. The program of the gymnasium group should include more apparatus work.

3. Crowded gymnasium classes should be avoided by excusing from the required gymnasium course, those students whose P.F.I.'s are over 114 in September. Those excused would be allowed but not required to select some activity.

4. The swimming program should be changed so that the students enter the water as quickly as possible. This means that the instructor will have to develop some method of quickly removing any "fear of the water" that the students may have. This should result in a marked increase in the P.F.I. during the first period and a consequent increase in power to swim. At all events students in this group should have more exercise during the first period.

5. The writer believes that the cross-country squad does not have sufficient arm exercise. These students should be advised to take additional exercises to increase their arm strength. This will probably not affect their cross-country ability greatly but it will increase their general fitness.

6. The football squad's practice periods should come at some other time than between 12 and 2 P.M. This would avoid the unhealthful ex-

pedient of practicing either on a full stomach or on an empty one. The writer believes that neither of these conditions is conducive to improvement in physical fitness—and the test results support this opinion.

7. The program for the abdominal group should be so designed or rearranged that the back muscles receive as much exercise in the second period as in the first period.

8. It is suggested that if the hockey coach would instruct his men how to shoot both left and right handed there would be an increase in the left grip and probably an improvement in playing ability.

9. The "Low P.F.I." group should be checked constantly by both physician and instructors so that as quickly as possible students will have their physical powers brought back to normal. In many cases this will require also investigations of home and living conditions.

10. *All students who have P.F.I.'s of eighty or below in September should be required to enter the "Low P.F.I." group and remain there until they have increased their P.F.I. sufficiently to be removed from the low classification, even if they remain in this classification for two or three or four years.* They should be encouraged to select an interest activity in addition under proper and careful supervision, unless contra-indicated. The interest activities should be those which have a carry-over value into adult life, like tennis or golf.

11. The results of this study should be shown to the students and be thoroughly explained. This should motivate them to select the activity which will be most helpful in increasing their fitness. This also may motivate the students to try harder to improve themselves.

The Effects of Various Summer Programs on Boys' Physical Fitness*

By Arthur L. Jones

THE PROBLEMS

SUMMER months should provide a period of physical recuperation for high school boys. Their indoor life is normally ended. They are freed from the restrictions of class recitations during the day and homework at night. They live in the sun, whether at home or abroad. Public and private camps abound to care for those who cannot easily reach lakes, streams, mountains, or seashore. Fresh fruits and vegetables ripen and drop physically and in price. The open road calls.

The normal expectancy is that, under these stimulating conditions, boys in their teens will thrive physically. Surplus weight should melt off. Exercise should harden muscles and sinews. The sun should turn white bodies brown. Sleep should be deep and sweet. Physical fitness indices of whatever kind—if they are valid measures of capacity for activity—should rise.

Do they?

The most appealing argument of summer camps to parents is their claims that they improve boys' and girls' health. Often they do. Often they do not.[1]

Of course, the traditional measure used by camps to "prove" improvement in health—increase in weight—is quite misleading.[2] For, as almost every parent really knows, many children badly need to lose weight.

How would you rate the various camps attended by your boys, Mr. High School Principal? How effective are local public playgrounds in maintaining children's health, Mr. Mayor? What are the effects of summer activities on your boy, Mr. and Mrs. Parent? What are the relative effects of light and heavy work on physical fitness, Mr. Employer? Shall parents require their sons to work? Or shall summer vacation be held sacred as a period of *re-creation?* Or might it be better, at least as far as health is concerned, to keep schools open during the summer months?

It was to secure some objective data which would aid the writer in

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* This study is an abstract of a Master's Thesis prepared for the University of Maine. The writer is indebted to Mr. Ralph Noonan, who is an instructor in Framingham Schools, for his assistance in testing.

[1] See articles on camping by Wylie, page 156; Malcolm, page 166; and Wrightstone, page 150.

[2] See Wylie's analysis, page 161–3. (Ed.)

answering these questions more accurately and with some assurance that the present study was undertaken.

No final conclusions can be given, for the complexity and interrelations of the problems render solutions extremely difficult and demand the analysis of perhaps thousands of records. Evidence is presented, however, to stimulate further investigations in this important field of inquiry. A few very tentative conclusions are drawn merely as suggestions to parents, camp directors, and school executives.

THE DATA

To measure changes in physical fitness, strength tests were given[8] in May and September, 1934. P.F.I.'s, and gains or losses therein for each boy, were calculated. Changes in weight were noted too, to demonstrate once more the lack of meaning in reports of weight gain alone.

Immediately following the September tests, boys were interviewed by the author, who is the local physical director. Their summer activities were noted and boys were later classified into five categories, in terms of the probable amounts of physical activity indulged in. This process of classification was subjective, being a "mere" estimate. However, the interviewer spent sufficient time with each boy to determine with more than a fair degree of accuracy whether he had been actively engaged during the summer vacation or whether he had been loafing. The categories were:

1. Loafing—little play and no regular work.
2. Light work—caddying and other intermittent jobs with little interest in other activities.
3. Combination work and play—a regular job for part of each day or part of the summer and some active interest in sports.
4. Heavy work—steady job all day.
5. Active freedom—concentrated activity in some sport or sports or camp.

Complete records were secured for 179 boys. The data for the various groups are reported in Table I. Since weight gains and losses are sometimes thought to be indicative of changes in health, these records are included also.

To provide material for greater insight into the changes in each group, six scattergrams are reproduced in Chart I.

THE RESULTS

1. From the data reported in Table I, it is apparent that inactivity during summer vacation is deleterious to health. For, though the normal expectancy is that boys will improve from 5 to 10 per cent in health, these seventeen boys declined an *average* of 14 per cent. The consequences of these declines are likely to be severely felt during the ensuing school year. Certainly their capacities to work, play, and study

[8] In the Framingham, Massachusetts, High School.

will be greatly reduced. Probably their abilities to withstand or throw off minor infections will be greatly lessened. Certainly, too, most of them will be less happy. These boys would have fared better if they had been put to work at any task.

2. The losses in P.F.I. of the light-work group were small but, on the average, unnecessary.

TABLE I

CHANGES IN PHYSICAL FITNESS AND WEIGHT OF HIGH SCHOOL BOYS DURING SUMMER VACATIONS

Group	Number of Boys	May P.F.I.	September P.F.I.	Gain or Loss	May Weight in lbs.	Sept. Weight in lbs.	Gain
I Loafing "little play and no work"	17	84.3	72.9	— 11.4 points — 14%	137.4	145.0	7.6
II Light Work "caddying and other intermittent jobs"	27	89.4	88.0	— 1.8 points — 2%	127.3	132.3	4.9
III Combination "some job and some freedom"	37	90.3	95.6	+ 5.3 points + 6%	135.4	137.7	2.2
IV Heavy Work "steady job all day"	36	89.2	95.4	+ 6.1 points + 7%	136.4	139.3	2.9
V Active Freedom "several sports or camp"	62	87.8	94.7	+ 6.9 points + 8%	132.9	136.3	3.4

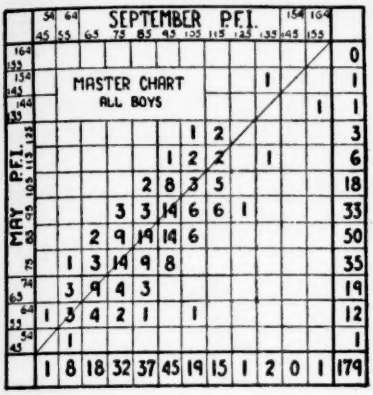
3. The gains of the other three groups are practically identical. That they were not greater may be due to some decline in fitness during the first two weeks of school. (It should be reassuring to those who still question the reliability of strength testing to discover how nearly alike are the findings of Wrightstone, Wylie, and the writer, who was privileged to see their reports.)[4]

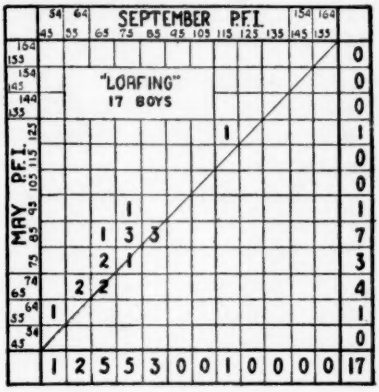
4. The scattergrams in Chart I reveal very interesting conditions.

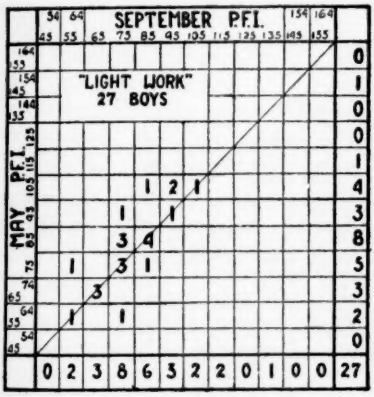
a) Not a single "loafer" gained in fitness during the summer.
b) In all other groups there were both gains and losses.
c) The greatest gains were in the "Active Freedom Group."

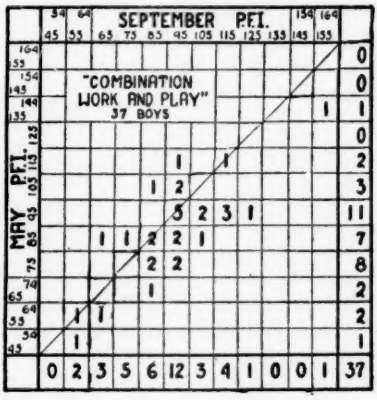
[4] The author is indebted to Kenneth H. Murray for the following data from Montreal: 159 boys tested in June and September 1934, median P.F.I.'s 111.66 to 109.6—a loss of 2 per cent. The correlation coefficient between the two sets of data was .66, showing an unusually wide degree of variations between individuals. Evidently some improved greatly while many declined considerably in P.F.I. Why?

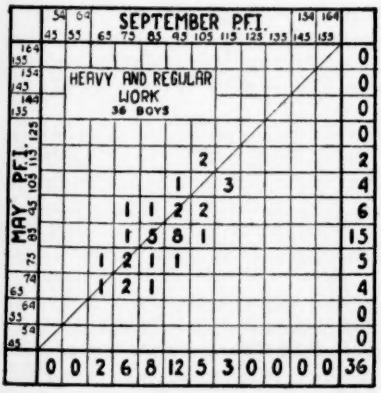
CHART I
MAY AND SEPTEMBER P.F.Is. OF BOYS IN FRAMINGHAM HIGH SCHOOL

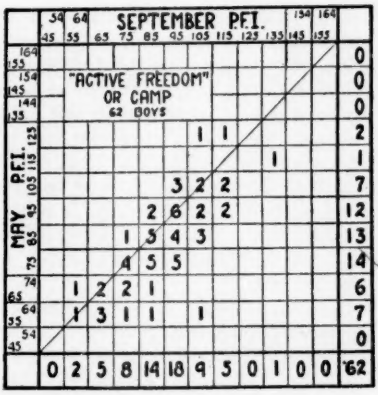












5. The greatest average P.F.I. losses were accompanied by the greatest average weight gains. The negative correlation here is very high.

6. Statisticians will be interested to note the distribution of boys in the various groups. The writer classified individuals without reference to P.F.I., and without any attempt to assign any proportion of boys to each group; yet a distribution polygon would approximate the normal curve, skewing toward the upper end as would be expected during summer months.

7. That great gains in fitness are possible, is revealed by those made by certain individuals in groups III, IV, and V.

8. Table I reveals, too, that pupils with low, average, or high P.F.I.'s may gain greatly in physical fitness, though, of course, those lowest in May are able to improve most. For example:

TABLE I

	May	*September*	*P.F.I. Gain*	*Per Cent Gain*
Boy in Group V	64	107	43	67%
Boy in Group III	137	162	25	18%
Boy in Group IV	88	110	22	25%

OUTSTANDING CASES

Brief case reports of a few of those whose gains or losses were greatest are included here to illustrate and supplement the bare statistics.

1. E.S., P.F.I., 95 to 80; weight 138 to 146. A case of loafing all summer. This boy considered himself "strong!" He uses "defense methods" in all conversations. The September test revealed his true condition. A talk with E.S. changed his attitudes, mental as well as social. He now is "out" for all sports and probably will improve rapidly in physical fitness, mental balance, and social attitudes.

2. R.G., P.F.I., 131 to 118, weight 111 to 132. Another case of loafing all summer, in spite of a high P.F.I. This is an unusual case in which a boy changed his normal living habits—because he was unsupervised by parents or others? He says "never again!" Possibly a period of rapid growth accounts for the change; but there is no evidence that the condition was normal or desirable.

3. W.R., P.F.I., 66 to 91; weight 130 to 132. A remarkable improvement for a boy in Group IV. His program was general farming for one week followed by swimming, hiking, and tennis for the remainder of the summer. Before the first test was given this boy, he was inclined to be lazy and inactive. Since May his attitude has changed greatly, as proved by test results.

4. D.A., P.F.I., 137 to 162; weight 100 to 96. This is an unusual case. In spite of a high May P.F.I., this boy increased his score very greatly. He did gardening for three weeks and engaged in sports for the remaining weeks. At times this boy has bad attacks of asthma. He is now excused from physical education because of a high P.F.I. His low and declining weight *coupled with* increase in P.F.I. mark him as a real problem case which should be followed carefully by school health officers and teachers.

5. E.T., P.F.I., 75 to 97; weight 111 to 120. This case is notable because of great weight increase with P.F.I. increase. Evidently this boy built muscle tissue, sinews, and bones during his summer, instead of fat. He clerked in a drug store mornings. Every afternoon he went hiking, canoeing, or swimming. The May P.F.I. score warned this boy of his needs and thus helped him to help himself.

6. P.T., P.F.I., 58 to 85; weight 124 to 132. Another case of weight and P.F.I. gain in Group V. Clearly a real improvement in general fitness. P.T. was a socially maladjusted boy. The director counselled with him. After a summer of tennis, swimming, bicycle riding, and baseball, he showed a wonderful change in social attitude as well as physical fitness.

7. U.N., P.F.I., 132 to 112; weight 114 to 122. Group V. This boy reported "baseball all summer" enthusiastically. But his weight gain without a proportionate gain in strength is inexplicable to the writer. Perhaps his "baseball" was as a "left fielder"—standing still most of the time.

8. L.B., P.F.I., 88 to 110; weight 114 to 119. L.B. worked all summer in a store where he was obliged to do much lifting. In spite of a considerable weight gain, his P.F.I. increased 22 points or 25 per cent.

CONCLUSIONS

1. The data are too meagre to warrant any sweeping conclusions. Rather has the author attempted to set up a method of investigation which ought to yield significant disclosures when applied to several hundred cases.

2. The known close relation between exercise and improvement of fitness suggests that boys classified as active, who lost in P.F.I. were (*a*) wrongly classified, or (*b*) over-strained by summer activities, or (*c*) have some hidden defect. In any case, they should be interviewed again to determine the real reason for apparent declines in fitness.

3. Loafing during an entire summer is inexcusable in growing boys who are organically normal. Parents of such boys ought to "take steps" either to put them to work or discover the inner reasons for their physical inaction.

4. Many forms of light work are but little better than loafing. Caddying, for example, when it means but a round or two a day, is likely to involve other practices prejudicial to health.

5. Apparently a combination of work and play or camping yields the best results in health improvement.

6. Camping and other forms of active freedom are beneficial. But camping is not superior to other forms of active summer living *unless the camp director incorporates in his program a regular and repeated testing procedure with modifications of individual programs to meet each boy's needs.*

7. From the health standpoint, all work and no play is as good as all play and no work, and far better than light work or loafing.

8. At least a fourth of the boys tested were stimulated by test results and succeeding conferences with the director of physical education to improve their physical fitness during the summer.

Measurement of Physical Fitness at Camp Brooklyn

By J. Wayne Wrightstone

SINCE the beginning of the present century, the growth of the organized summer camp has been phenomenal, and for several reasons. Cities increased in population, and the trend of urbanization caused a curtailment of adequate areas in which the youth of the city could play. The streets became congested with traffic, vacant lots decreased in number, industry ceased to absorb its usual quota of youth; so schools, parks, and recreation centers became over-crowded. The city parents' problem was to find a suitable place for children to grow in summer without jeopardy. The organized camp helped to solve the problem.

In his popular *Handbook,* Porter Sargent writes that "Camp directors are moved by a common purpose: to give to the young people in their charge a summer of happy, wholesome, out-of-door activity to the end that their bodies, minds, and characters—*especially their bodies*—shall be stronger in the fall."[1] Dimock and Hendry used part of a "Summer Camp Test," which is regularly employed at Camp Ahmek, to find out what the boys themselves considered the most valuable acquisition from a summer spent in camp. These investigators found that boys considered "Better health, physical fitness, posture, etc." as one of the three most valuable acquisitions.[2]

Practically all camp directors mention in their camp literature the fact that a season in camp greatly improves the camper's health, but the directors usually make no attempt to substantiate such statements with definite proof. In the early days of the summer camp movement, the mere fact that the child appeared healthier after his sojourn in camp was the only health measurement employed. But as the number of camps increase, and their organization becomes more thorough, both parents and directors are requiring more definite proof that the summer camp improves the child's physical fitness.

It is curious that the chief measure used to "prove" the health values of camping is increase in weight. Of course the plain fact is that many children greatly need to lose rather than gain in weight. Malling-

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[1] Porter Sargent. *A Handbook of Summer Camps,* 8th Ed., p. 16.

[2] Dimock and Hendry. *Camping and Character,* pp. 17, 18. New York: Association Press, 1929.

Hansen[3] has adequately shown that adolescent boys and girls have three periods of normal growth annually—and particularly that in the summer period there is a great gain in height *coupled with a loss of part of the weight gained in the spring period!* Evidently directors of camps who rely on weight increases as measures of gain in health are misleading many parents, as well as themselves. But this only emphasizes further the need of a truly valid measure of physical fitness, to reassure parents, to improve camp programs, and to determine the effectiveness of routines and personnel. This report concerns itself chiefly with such a measure.

CAMP BROOKLYN'S HEALTH PROGRAM

In an attempt to furnish proof of improvement, the camp directors of Camp Brooklyn instituted in 1934 a set of comparative physical examinations. A few days after the boys arrived in camp they received their first examination; and a few days before they departed they received their second. In former years the camp nurses and camp physician, a medical student, made a more or less casual examination of each boy's heart, lungs, blood pressure, skin, etc. Any serious deviation from the normal was recorded. In an attempt to determine if the summer had improved the boys' physical fitness, the findings of the two examinations were compared.

These traditional health examinations and comparisons, though considerably more valid than weight measures, proved practically nothing; for the physician's examinations, besides being casual, were of necessity highly subjective. Mere "yes" and "no" records or check marks to indicate the presence or absence of serious defects provided almost no basis for accurate comparisons.

To furnish more definite proof of improvement in the camper's health, camp directors selected the "Physical Fitness Index" tests, which are highly objective, as well as reliable and valid measures of health and physical condition. By giving these tests to the boys at the beginning and again at the end of the season, definite indices could be secured which would show whether the sojourn in camp improved or impaired the boys' health.

When a boy arrived at Camp Brooklyn during the season of 1934, he was given a medical examination for heart, lung, skin, and hernia condition. If the boy's physical condition warranted his taking the "Physcial Fitness Index" test, the use and purpose of the test was explained to him, and he then proceeded to go through the seven physical capacity tests. Measurements were taken with care, and the whole test was conducted with the necessary vigilance.

After the boys underwent these various initial tests of physical fit-

[3] Malling-Hansen, *Perioden im Gewicht der Kinder und in der Sonnenwärme*, Kopenhagen, 1886.

ness, the scores of which were properly recorded, they were privileged to engage in the many activities which Camp Brooklyn offered. The aim of the camp was to teach that sports are not ends in themselves, but means towards ends: namely, health, pleasure, self-control, and character.

Field Sports.—The camp had two main sections, junior and senior. The junior section comprised boys from nine to fourteen years of age; the senior section, boys from fourteen to eighteen years of age. Each section had its own program of group and individual field sports. Contests were held in baseball, volleyball, track, swimming, basketball, tennis, boxing, wrestling, and touch football. A hiking club was formed in addition to the usual over-night hikes and three-day canoe trips.

Water Sports.—The junior and senior sections used the facilities of the waterfront extensively. In addition to regular daily mass swimming periods, instruction was offered in boating, canoeing, diving, recreational swimming, advanced swimming, sailing, life-saving, and water games.

Medical Care.—Adequate precautions were exercised to protect the campers' health by proper sanitary measures and frequent inspections. Incoming food was inspected, drinking and washing water were analyzed, and sewage disposal supervised. Cabins were inspected daily, and the personal cleanliness of campers was checked. Colds, fatigue, and similar dangers were quickly detected and cared for at the infirmary. Special illness was diagnosed and treated by a licensed physician.

PRESENTATION OF DATA

Because of late arrivals or early departures, usable data were secured for only fifty campers. The initial tests were administered during the first week at the camp, and the final tests during the last week. No other testing was possible because the testing apparatus was rented for only the first and last weeks of the camp season. The camp season was nine weeks in length.

Certain uncontrollable factors influenced the Physical Fitness Indices which were obtained. First, some of the boys had caught colds shortly before the administrations of the final tests. For almost two weeks rainy and inclement weather not only caused some boys to catch colds, but enforced indoor instead of outdoor physical activities on all. Second, the final week's unusual program of fairs, carnivals, the season's banquets and final campfires may have affected the physical energy and strength of the campers. Third, the spirometer used for the final testing of lung capacity seemed by all empirical tests to measure consistently under the capacity indicated by the spirometer for the initial test. This decrease was laid to some systematic error in the measuring instrument. The indices have been computed without any attempt to correct this error. All of these uncontrollable factors have served to

reduce calculated increases in Physical Fitness Indices, but despite these hindances a creditable gain in physical fitness is indicated for the camp season.

Though data were obtained for only fifty campers, the figures available are sufficiently indicative of the trends in physical fitness to be of value in the interpretation of results of the health program at Camp Brooklyn. Figure 1 gives the distribution of the P.F.I.'s of fifty campers on initial and final tests, and a graphic representation of the cumulative frequency curves.

Physical Fitness Indexes	*Initial Test*	*Final Test*
120–130	0	3
110–120	6	8
100–110	11	11
90–100	10	10
80– 90	10	8
70– 80	9	8
60– 70	2	1
50– 60	2	1

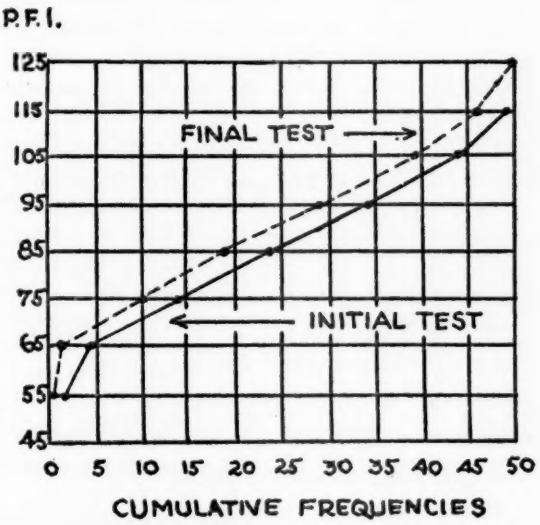

FIG. 1.—Cumulative frequency curves of physical fitness indices on initial and final tests, indicating consistent gains of campers in an eight-week period.

An inspection of Figure 1 will indicate that there was a gradual shifting of frequencies from the lower indices to indices a step or two higher. In step 120-130, for example, no camper attained that high an index on the initial test. Three campers, however, attained an index in this step on the final test. A detailed comparison of average indices for 50 campers at the beginning as compared with the end of the camp season is presented in Table I. The graphic representation is depicted in Figure 2.

TABLE I

AVERAGE GAINS OF FIFTY CAMPERS ON PHYSICAL FITNESS TESTS ADMINISTERED AT THE BEGINNING AND END OF THE CAMP SEASON

Physical Fitness Tests	Campers	Average P.F.I. on the Test	Standard Deviation	Difference of Averages	P. E. of Difference	Ratio
Initial Test	50	90.52	16.20	6.50	1.16	5.3
Final Test	50	97.02	15.55			

The average index which 50 boys had when they were given the initial test at Camp Brooklyn was 90.52. This index is almost 10 points below the normal index of 100.[4] The interesting finding, however, is that the average index which these same boys attained on the final test at the end of the camp season was 97.02. While this index is about 3 points below the normal index of 100, it represents an average gain during the camp season of 6.5 points per season camper. The probable error of the gain is 1.16, and the ratio of the gain to its probable error is 5.3. The gain, therefore, is demonstrated to be reasonably reliable and significant evidence of the efficiency of the camp's health program for increasing physical fitness. The gain would probably have been greater if the related factors of colds, unusual final programs, and possible defective registering of the spirometer scores might have been controlled.

On the other hand, twenty out of fifty boys given both tests lost in P.F.I. during the eight weeks elapsing between tests, their median loss being eight points. These losses represent real problems in camp management which more frequent tests would have discovered.[5] A more effective adaptation of activities to individual needs would eliminate most of these losses and thereby greatly raise the camp average gain in physical fitness—and therefore the pleasure of campers and the success of programs to improve social efficiency.

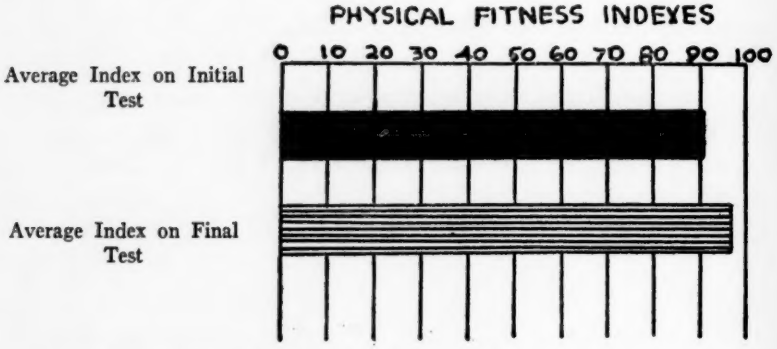

FIG. 2.—Average physical fitness indices on initial and final tests, including average gain for campers in an eight-week period.

IMPLICATIONS OF THE FINDINGS

Several implications seem evident in the findings of this initial study of physical fitness among the season campers at Camp Brooklyn. *First*, the camp program of field sports, water sports, sanitation, and

[4] These relatively low averages are at least partly due to the relative inexperience of testers. (*Ed.*)

[5] See John Malcolm's results when bi-weekly tests were given. Page 166.

first-aid does definitely contribute to the building of physical strength and prowess. *Second,* the Physical Fitness Index may be used as a guide for a detailed analytic, diagnostic, and remedial program for counseling with individual campers. *Third,* the objective evidence supplied by the physical fitness tests is far more trustworthy and reliable than subjective evidence usually adduced from casual medical examinations.

Not only should the results of objective physical fitness tests be used for the reconstruction of the individual camper's programs and activities, but also the *camp's* program and activities. These two are inseparable parts of a total picture, and changes in campers' conditions and needs must be accompanied by corresponding changes in the camp curriculum.

The results of the physical fitness tests were also employed this year in the following ways: in group competition in baseball, basketball, and track, teams were equalized in such ways that the total Strength Indices of competing teams were approximately the same. A beginning was made in the use of the P.F.I. as a diagnostic instrument for counseling and building remedial programs for individual campers. The results were used mainly, however, to provide an objective survey of the health program of the camp.

PROPOSED USES FOR NEXT YEAR

Next year it is hoped that testing equipment will be in the camp continuously for the entire season. This will permit weekly or bi-weekly testing of the campers. Then the indices might be used as follows:

1. To equalize teams for competitive sports.
2. To assign to physicians for more careful diagnosis all low P.F.I.'s.
3. To reconstruct continually camp health and physical education programs to group and individual needs of campers as revealed by P.F.I.'s.
4. To send a simple explanatory report of each camper's P.F.I. and his program to his parents as often as possible.
5. To survey the efficacy of the camp's comprehensive health program.

Thus, the measurement of physical fitness at Camp Brooklyn will become an integral and functional part of creative health and camping. The camp program will be adjusted to the boys' interests and needs and the boys will participate in determining the policies and practices of camp health and physical education.

A Program of Measurement in Health for Boy Scout Summer Camps*

By James A. Wylie

EVER since the first summer camp for boys was organized by Ernest Balch, in 1881, the objective *health* has held an important position in the reasons for sending boys to camp during the summer months.

There is no doubt about the importance of this objective, for we find everyone concerned with camp—the boys, their parents, and the directors themselves—mentioning health benefits as possible outcomes of a stay at a summer camp.

Specifically, the challenging statements of J. Edward Sanders and John Dewey prompted this study.

J. E. Sanders observed:

"There has been a tendency to assume among both parents and camp leaders that the mere fact that a child is in camp is proof sufficient that his health is being benefited, his physical stamina and vitality increased."[1]

John Dewey's challenge is more definite:

"To profess to have an aim and then neglect the means of execution is self-delusion of the most dangerous sort. When we take ends without means, we degenerate into sentimentalism. In the ideal we fall back upon merely luck and chance and magic or exhortation and preaching." [2]

These two statements, when applied to the problem, leave in our minds the questions, "Are we improving the health of the campers? If so, how much? If not, why not?"

During the summer of 1932, therefore, the writer endeavored to discover just what was being done in the light of this objective, at Camp Waubeeka, operated by Bronx Valley Council, Boy Scouts of America.

Up to this time our only measure of health had been a physician's examinations at the beginning and at the end of the boys' stay at camp. His estimates of improvement or decline were data from examinations of the heart, lungs, blood pressure, skin, hernia, etc.—the usual medical inspection. Any deviation from the normal was noted. This done, the camp doctor then usually forgot all about the boy for the remainder of his stay at camp until the leaving examination, except for an occasional treatment for sunburn, cuts, etc.

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* This report is a summary of the writer's Master's Thesis, on file in the Boston University School of Education Library.

[1] J. E. Sanders, *Safety and Health in Organized Summer Camps*, p. 80.

[2] John Dewey. The source of this characteristic statement has been temporarily lost.

The findings of the two examinations were then compared to discover what improvement in health had resulted. Naturally, the type of examination conducted made it very difficult, if not impossible, to discover any changes in the individual. Naturally, the boy, because of his environment and activity, would have many more cuts, scratches, bruises, etc., than when he first came to camp. If the camp doctor were to consider such data, then he would undoubtedly be inclined to estimate that the boy was now in poorer health than when he arrived. But is this necessarily so?

The bare statement of this haphazard method of measuring health reveals its inefficiency. It seems to be hardly more accurate than mere guessing. In the light of our professed objectives it seems a most serious deficiency of summer camps. A change in testing technique was indicated as a first prerequisite to any reliable approach to the problem of effecting or determining improvements in physical fitness in our camp.

THE TESTS AND PROCEDURES

1. In approaching the problem of measurement in health in summer camps for boys the first step was the selection of a valid and reliable measure of health. By good health we mean, unless otherwise stated:

"That condition of any living organism, including its parts and functions, which conduces to the greatest amount and highest quality of purposeful activity."[3]

The term *physical fitness* is meant to be synonymous with physical health.

2. After canvassing the field of tests we discovered that the only test of established validity, reliability, objectivity, and possessing an adequate set of norms, was the Physical Fitness Test from which is derived the "P.F.I."

3. This composite test was given to 140 campers on the day they arrived in camp and again on the day they left camp. The difference between the two scores was accepted as a significant measure of change in the health of campers during the intervening period.

4. In an effort to determine the reasons for P.F.I. changes, a record was kept, of (*a*) campers' participation in activities and (*b*) any accidents and injuries they may have suffered. A questionnaire was later sent to boys and parents to discover, if possible, just what were the boys' emotional attitudes and reactions to the camp. These questionnaire replies were used to supplement the material collected during the summer.

5. A survey, too extensive to bring into this brief article, showed that the camp directors had carefully considered the chief factors affecting health. Particularly had provision been made for a healthful en-

[3] Frederick Rand Rogers, *Fundamental Administrative Measures in Physical Education*, p. 28. Newton, Mass.: The Pleiades Co.

vironment, excellent program, and the best possible leadership obtainable.

PRIMARY RESULTS

The results, in brief, of the summer's program as revealed by P.F.I.'s were, of 140 boys tested,

1. One hundred and five boys increased their scores, showing that they had had an increase in physical fitness—or "capacity for physical activity"—as a result of their stay at camp.

2. Forty-one boys, of the above, increased their scores from below normal to normal and above.

3. Thirty-one boys declined in physical fitness.

a) The losses of twenty-one boys were so small as to be considered insignificant and in no way detrimental.

b) Ten boys had losses in health which were classified as detrimental.

4. Median P.F.I. gains were from 106 to 114—an average of 8 per cent.

Thus, even the most cursory analysis of results is startling, for it reveals that, while great average gains may be made, our health claim is not valid for many individuals, for at least 20 per cent of the boys actually declined during their stays of from two to six weeks.

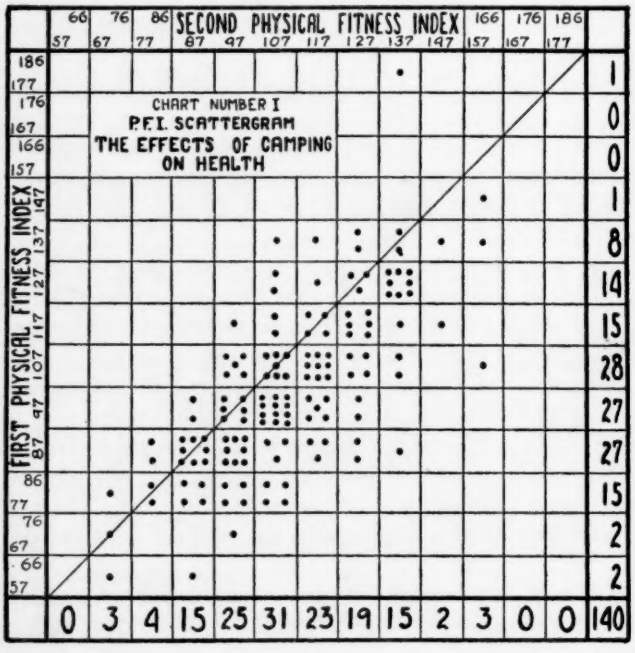

CHART I
P.F.I. Scattergram: The Effects of Camping on Health

There are many possible causes for these losses. For the subjects studied, however, there were two outstanding causes of loss of fitness which were revealed by observation during the camping period and subsequent inquiries among boys and parents.

The first of these causes of declining fitness playing a part in the camp studied was the mental attitude of some of the boys towards camp and its entire program. A typical example is the report below which shows just how a poor mental attitude towards camp caused a loss in bodily health.

Case No. 1

A— H—, 11 years, 9 months old. His first P.F.I. was 104. At the end of his stay at camp, his P.F.I. was 99.

This was A's first stay away from home. After being at camp for two weeks his mother decided that he should return home. However, the father insisted that the boy remain in camp. At the end of the first month the father again insisted that the boy remain in camp because he had "signed up" for the entire summer. At this time, the boy's score had decreased to 103. During the following period A— became so determined to go home that at the end of the sixth week his father finally agreed to his son's request. By this time his P.F.I. had decreased to 99.[4]

This is but one of five examples indicating that the mental attitude of a boy regarding home and camp was a dominant factor in the maintenance and development of health.

EFFECTS OF INFECTIONS AND ILLNESSES

It is reasonable to assume that the fitness of campers is influenced to a large extent by the way the camp treats illnesses and injuries. But objective evidence is better than conjecture. Therefore, a special study was made to determine the effects of illnesses and injuries on campers' P.F.I.'s.

The camp studied had an excellent record, when considered in the light of absence from illnesses and injuries. Only those cases which were serious enough to come to the attention of the camp doctor are mentioned here.

The following table shows the relation between accidents and illnesses on the physical fitness of those who were injured or ill.

The average increase in P.F.I.'s for the entire camp for the complete season was eight points.[5] It is interesting to note that for only three ailments did we find a decrease below that of the average increase. This suggests that the health of campers is not seriously affected, as a rule, by minor illnesses or injury. In fact, all cases, by average, have shown some increase and no definite loss.

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[4] This case report indicates the high reliability of the P.F.I. when tests are given by skilled testers. (Ed.)

[5] This was almost identical with that for Camp Brooklyn. (See page 150.) However, the latter camp held all its boys for nine weeks, while many at Camp Waubeeka remained only two weeks.

EFFECTS OF CURTAILED EXERCISE

In the survey of the health of the boys we reported that ten boys had decreases in health that were sufficient to be classified as "detrimental." Investigation reveals that the reason for fitness declines for five of these boys was improper mental attitude. *It is interesting to discover, however, that of the five remaining cases of serious loss of health four have been traced directly to lack of sufficient exercise.*

TABLE I

Illness or Injury	Number of Cases	Average P.F.I. Increase of Those Having the Ailment
Colds	25	9.0
Sore Throats	21	8.0
Cuts	17	5.4
Ringworm	14	12.0
Sprains, strains, bruises	14	17.0
Nausea	9	.8
Infected Wounds	9	6.5
Poison Ivy	5	10.0

To illustrate this point the following case will suffice:

A— G—, fifteen years and four months old. His first P.F.I. was ninety-six and his second was eighty-six. A— G— was not a very "social" boy. He was greatly interested in nature work. He would go off by himself for hours and listen to the birds, collect flowers, leaves, and plants.

During his two weeks' stay at camp he went swimming only eight times. He did not go on any of the special trips, such as the three-day hikes and canoe trips. He entered no swimming meets or athletic events. Whenever a team game was in progress he would be off some place so that he could not be reached or asked to participate.

These mental attitudes and interests prevented him from getting sufficient exercise to build him up physically. Hence it was natural that he should lose in physical fitness. The extent to which he lost is fairly accurately represented by the difference between his P.F.I. scores. The loss was about 11 per cent.

It was impossible for us to discover just exactly why the tenth boy lost in health. All our observations and testing failed to reveal a logical reason. Perhaps if the boy had been under our care for a longer period of time, we might have been able to discover just what the cause was. He remained at camp only two weeks.

THE VALUES OF SPECIFIC ACTIVITIES

There are bound to be differences in the values of various activities as developers of "health," or "physical fitness" or "capacity for abundant living." Any analysis of specific activities will show that although all have common elements, they differ in many ways. Some activities

require more skill, some more endurance, some more courage, some more native ability.

An analysis of the Camp Waubeeka program reveals that according to the measurements used and the methods followed at this camp for this year the various activities should be rated, in general, and tentatively, for their contribution to development of health, about as follows:

1. General canoeing
2. Speed swimming
3. Life-saving
4. Canoe trips (four days)
5. Basketball
6. Track
7. Three-day hikes
8. Touch football
9. Volleyball
10. Soccer

Other activities rated so low in improvement of fitness that they were not included in the list. When the above list is examined, it will be discovered that those events which seem to include all functions and conditions which promote *and require the greatest amount of practice and effort* are those that rate the highest in the development of health.

Table II shows the sports mentioned by boys as the ones they played most during their stay in camp. The Table shows whether they lost, remained constant, or gained in health, the percentage who gained, and the average gain in physical fitness, as shown by the physical fitness index.

TABLE II

Sport	P.F.I. Change		Total Cases	Per Cent Gaining	Average P.F.I. Gain
	Loss	Gains			
Track	0	10	10	100	14.1
Basketball	3	17	20	85	11.5
Baseball	5	31	36	86	11.0
Swimming	5	37	42	88	10.3
Hiking	1	5	6	83	9.6
Touch Football .	1	11	12	91	8.4
Volleyball	6	28	34	82	7.0
Soccer	5	14	19	73	6.0
Quoits	0	6	6	100	5.1

The conclusions suggested by the above data are that as individual sports, track, basketball, baseball, and swimming were, for the boys studied, most effective in the development of health.

CORRELATION BETWEEN GAIN IN WEIGHT AND IMPROVEMENT IN HEALTH

Many camps state somewhere in their catalogue something of this sort—"Our boys gained a total of 187 pounds during the last camping season."

What does this mean? Does it mean that a boy who gains five or ten pounds, perhaps mostly in fat, is more healthy than the boy who has

been very active and has remained constant or even lost slightly in weight? As is apparent to the most casual observer, often a loss of weight is to be desired![6]

The scattergram, Chart II, compiled from the results of the tests conducted at the camp investigated shows a negative correlation. The *r* is —.043.

There are cases of gain in weight and gain in physical fitness, gain in weight and loss in physical fitness, loss in weight and loss in physical fitness, loss in weight and gain in physical fitness, and constancy in weight and gain and loss in physical fitness! Thus, the gain-in-weight measure of health or the P.F.I. measure (or both) is improper as a measure of "health improvement for boys during summer camp." But the American Child Health Association has already demonstrated the invalidity of weight-height indices; Malling-Hansen has shown that it is normal for many children to lose during summer months, and simple observation suffices in many cases to support this contention. On the other hand, the P.F.I. has been adequately and repeatedly proved to be a very highly valid measure of general health.[7]

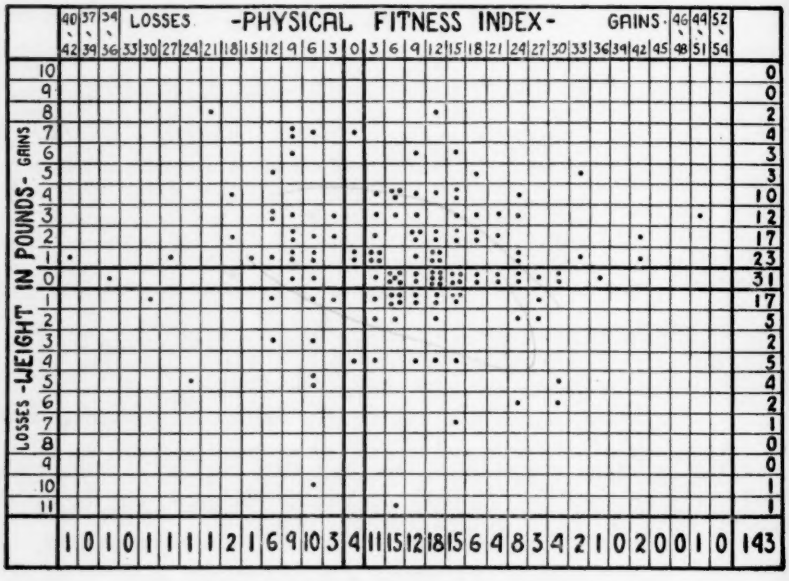


CHART II

Scattergram: The Correlation between Change in Weight and Change in Physical Fitness—Summer, 1932

[6] See also the comment and note on page 144.

[7] See particularly Chapters X and XI of Rogers' *Fundamental Administrative Measures in Physical Education.*

From our observation, the value of gain in weight *over a long period of time* is to show that growth is present. Not that increase in the size of skeleton and muscles is *necessary* for health, for it is not, but that, generally speaking, growth is "one of the signs of health in children."

Hence the conclusion is indicated, as a result of the investigation in the camp studied, that there is no reason to believe that gain in weight *per se* has any significance as a measure of health improvement at summer camps.

THE OPTIMAL PERIOD OF STAY AT CAMP FOR OPTIMAL HEALTH DEVELOPMENT

J. Edward Sanders in his investigation regarding the length of stay at camp and the effect it had on health says: ". . . *the data indicated that the longer children remained in camp, the more likely they were to become ill.*"[8]

If Sanders' findings, in the investigation he made of 114 camps, are indicative of the conditions in most camps, then the summer camp has lost claim to one of its greatest values.

However, it is important to recall that Sanders apparently defines health as absence of disease, illness, and injury. It is significant that he gave no positive definition of health in his survey. Nor did he have access to objective or normed test reports.

The chief interest in our study was in the development of health in our own camp. The following table shows the average gain in physical fitness on both the second and first tests along with the length of stay at camp.

TABLE III

THE EFFECTS OF LENGTH OF STAY IN CAMP ON P.F.I.

Length of Stay	First P.F.I. Test Average	Second P.F.I. Test Average	Average Change in P.F.I.	Per Cent Change in P.F.I.
Two weeks	108	113	+ 5	5
Three weeks	108	121	+ 13	12
Four weeks	110	116	+ 6	5
Six weeks	109	123	+ 13	12
Eight weeks	95	115	+ 20	21

These data indicate that campers who remained eight weeks at camp had the greatest improvement in health, as shown by the Physical Fitness Index.[9] However, it is significant that the eight-week campers who gained most had the lowest beginning P.F.I.'s. This condition agrees with that found by others, and reduces somewhat the implied claims that camp routine improves health more than does remaining at home.

[8] J. Edward Sanders, *Safety and Health in Organized Summer Camps*, p. 13.

[9] See also Malcolm's analysis on page 166.

CONCLUSIONS

1. Substantial health gains were made during a period of stay in the camp studied. One hundred and five boys made definite gains in physical fitness as determined by P.F.I. tests. This means that they gained in muscular powers more than average boys would gain during similar periods of time and with similar gains or losses in weight.

2. The program presented did not fit the individual needs of all the boys, for thirty-one boys lost in health. Ten of these losses were serious. Twenty-one were insignificant.

3. Those boys whose exercise habits were below average showed very small increases in fitness or lost very definitely in health.

4. Long hikes and canoe trips had a beneficial rather than a detrimental effect on health.

5. There seems, as a result of this study, in this particular camp, to be no correlation between gain in weight and improvement in health for boys in summer camps, and therefore that *the use of weight gains to "prove" the value of any summer program for adolescent boys is misleading to parents.*

6. The eight-week stay in this study proved to be most beneficial to campers.

7. Merely living in a rural environment does not in itself guarantee improvement in health.

8. Programs of activity should be arranged and controlled to meet the physical needs and limitations of the campers participating. Special adjustments to individual needs are essential to a proper program.

9. Enjoyment of what one does plays a very important part in the development of health. *It is worse than futile, at least from the standpoint of health development, to force homesick boys, or boys who are otherwise unhappy in camp life, to remain.*

10. Sore throats, colds, cuts, infected wounds, etc., apparently did not greatly retard the development of health at the camp studied.

11. The conclusions reached above are findings for the camp studied, and for the particular program and year during which the study was made. Nevertheless, there is little doubt in the writer's mind that they may be duplicated at many other camps throughout the country, whether conducted by Boy Scout, Y.M.C.A., or other organizations.

12. This leads us to conclude that if activity programs of camps were built around the findings of preliminary or first P.F.I. tests, then camp directors would be able to prescribe specific amounts of intensive activity which would fit the individual needs of campers far more effectively than they do now.

13. Once we determine needs by objective tests, and then meet these individual needs and measure results, we can safely state that we are

improving the health of the campers in our charge. Then, and only then, our claim of health development will be valid.

PLANS FOR THE 1935 CAMPING SEASON

The findings summarized in this report (which was prepared in 1932) have been substantiated by similar findings during the years of 1933 and 1934 at Camp Waubeeka. These verifications increase our assurance of their validity to such an extent that we now base our entire health program on P.F.I. tests supplemented by camp physicians' recommendations.

During the 1935 season we plan to:

1. Test all campers every two weeks. This will enable us to check our own progress for the preceding two weeks and allow for more effective adjustments of our program to the individual camper.

2. Give to the ten most needy campers the very best individual attention, placing them in the hands of an experienced man who will be in complete charge of developing them physically with the aid of medical advice. For these boys the entire morning will be set aside for physical development under these two men.

3. Improve and emphasize those particular activities that have the greatest value in developing the physical fitness of the campers.

4. Experiment with those activities which have been reported as low in value, to determine, if possible, whether one can improve in some way their value to the program or eliminate them from our program to make more room for the more valuable activities.

Meeting Individual Health Needs in a Y.M.C.A. Boys' Camp

By John Baden Malcolm

INTRODUCTION

SEVEN years of directing boys' camps have convinced the writer that the primary objective of parents in sending their offspring to camp is that the boys may develop strong, healthy bodies and build up a store of resistance against the cold, diseases, and indoor life of winter months. In this conclusion such authorities on camping as Sargent, Gibson, Dimock, and Hendry[1] concur. All other parental interests and purposes are subservient to this one.

Inasmuch as the greatest concern of parents is the health of their boys, camp programs should be conducted to produce the greatest amount of physical fitness within reason for each boy. Moreover, since it would be absurd to assume that just because a boy is in camp his health is being benefited, two of the camp director's chief functions are to discover, by valid and reliable means, whether the program determined upon for each camper fulfills these objectives; and to make such changes, from week to week, as each boy's changing condition requires.

This study reports the results of a fairly thoroughgoing attempt to determine each boy's physical condition and needs, and to adapt the program to these needs in a typical Y.M.C.A. camp during the summer of 1934.

As contrasted with programs during previous years at this and other camps, the new adjustments reported hereafter were most gratifyingly successful. They not only made it possible to improve each boy's physical powers greatly (which could not have been accomplished under the old non-testing and unimaginative method of treating all nearly alike) —but they also greatly increased the staff *esprit de corps,* reduced camp disciplinary problems almost to the vanishing point, and greatly increased the boys' enjoyment of camp activities. But perhaps most significant of all, the interest and approval of parents in the camp, its management, and its values were multiplied several fold. This is best proved by objective measurement: parents who came to take their boys home left them for two, four, even six weeks more. *The director estimates "conservatively" that boy-weeks at camp were increased approx-*

[1] Porter Sargent, *A Handbook of Summer Camps,* 8th Edition, page 16; H. W. Gibson, "Administrative Problems," *Monthly Library on Camping,* Vol. IX, page 45, 1927; Dimock and Hendry, *Camping and Character,* Chapter II, page 19, 1931.

imately 30 per cent by the new testing and individual-needs and equality-between-teams programs.

The reader should remember throughout his reading of this report that the stressing of social adjustments, the development of skills, and the improvement of character need not be neglected in camp programs which are directed primarily towards health improvement. Nor were they neglected at this camp. In fact, these phases of camp life are enhanced by this procedure. Critical observation of problem cases has led the writer to conclude that boys are almost automatically better adjusted socially if they are improved physically. As Luther Burbank observed, "The healthy child has a thousand times the opportunities and the possibilities of a sickly one." The staff at the camp under discussion made excellent uses of these opportunities to develop social character.

The study reported below was conducted at Camp Ousamequin, one of the boys' camps of the Boston Y.M.C.A. The boys attending this camp are a representative cross-section of society. The P.F.I. Test was chosen as the chief instrument of measurement because of its proved validity, reliability, and objectivity, and because it provides two measurements which serve two very different purposes. The P.F.I. aids in determining health status, needs, and progress; the S.I. measures athletic abilities, and thereby makes possible the equalization of opposing teams and, therefore, the promotion of good social attitudes—"social efficiency." Both of these were used constantly throughout the eight weeks' camping season.

THE PROGRAM

This camp follows the familiar Y.M.C.A. or Boy Scout program of two-week camping periods. Boys arrive at regular intervals throughout the summer, are cared for by a permanent staff, and leave after stays of two weeks at the least, or some multiple of two weeks.

During 1934, upon arrival in camp, each boy was given a medical examination, which was followed the next morning by the physical fitness tests. This procedure enabled every boy to have a night's sleep so that the journey to camp would not affect his first test. Succeeding tests were given at the same time of day and under similar conditions. The same apparatus was used throughout the summer, and the same counselors handled the same pieces of apparatus for each test.

All boys having a P.F.I. of 90 or above entered into the regular camp program. Boys whose P.F.I.'s were below 90 were re-examined by the camp physician and interviewed by the camp director to determine the predisposing cause or causes for their low scores.[2]

[2] In view of the skepticism of inexperienced critics concerning the attitudes of physicians towards P.F.I. tests, it is significant to note that in practically every case known to those who use P.F.I. tests, the consulting and supervising physicians have become enthusiastic supporters both of testing and of subsequent adjustments to meet individual health needs. This is particularly true of physicians at summer camps.

A "prescription," or program, was then written for each boy in terms of exercise, rest, food, sleep, contacts with other boys, hobbies, and other interests. This prescription was prepared by the camp director, camp physician, and counselor involved. All members of the camp staff were then informed of their parts in the administration of these prescriptions so that the effort to improve the physical conditions of the boys was an organized one. Some boys were given mid-morning and mid-afternoon lunches with moderate exercise; others were placed with counselors able to control their eating habits, and heavy exercise was advised; still others, especially the younger boys with low P.F.I.'s, played games and tournaments during the cool mornings almost exclusively, and did their handicraft and shop work during the warm afternoons.

Two weeks later the boys were again tested. If they remained for two, three, or four two-week periods, they were tested at the end of each period, and P.F.I.'s were calculated. These scores provided an excellent check on the program for each boy, as they showed the amount of his gain or loss in true "fitness for life activities" and indicated the need of further modification of his program.

Some critics experienced in P.F.I. testing were skeptical about this measurement program, believing that a two-week interval was too short for any significantly measurable change in fitness to take place. These critics usually tested their groups six to eight months apart and base their judgments on the slight gains made by most boys during the fall and winter school months. However, *this study definitely proves that under controlled conditions results can be obtained in a short space of time.*

THE RESULTS—ALL BOYS

The records obtained were analyzed, first, in terms of the number of two-week periods the boy remained in camp, and second in terms of calendar periods. In addition, the P.F.I.'s obtained by retesting forty-seven boys on December 29, 1934, were compared with the scores made by the same boys while they were in camp.

The testing program and subsequent reports thereon were enthusiastically received by parents since they were able themselves to compare the scores on their own boys' cards. Both the camp physician and the director were busy on visitors' days explaining the scores to interested parents. Often parents who called to take their boys home decided to let them remain for another period because of the gains shown by the tests. Of the sixty-five boys entering camp the first period, fifty remained for the second period, *which was thirty more than had originally planned to stay.*

Of 149 boys who were tested two or more times, only 16 showed any loss of fitness on leaving camp. Thirteen of these 16 boys remained in the camp only 2 weeks. Thus, they entered camp, were examined and

tested, stayed 2 weeks, were retested and went home: *they were gone before anything could be done to correct their losses.* The majority of these 13 boys lost in fitness because of a rapid gain in weight: they did not remain long enough to convert the fat into effective muscle tissue.[8] Inasmuch as most of them gained in Strength Index, their slight loss in Physical Fitness Index was of no real concern. Another 5 of the 149 did not gain or lose, their entering and departing scores remaining the same. Again it is interesting to note that 4 of these 5 boys remained in the camp for only two weeks.

Making no differentiation of results for different lengths of stay in camp, the median P.F.I. gain for all boys was 19.8 per cent. By calendar periods, the median gain was 8.28 P.F.I. points or 7.8 per cent for each 2-week period.

These results are remarkable, particularly when compared with those in camps where tests are given *only* at the beginning and end of camping periods. The differences reveal how much more may be accomplished by the more frequent tests and modifications of programs.

THE RESULTS—BY TWO-WEEK PERIODS

Further analyses by two-week periods reveal much of interest and significance. Tables I and II provide data which indicate the superior values of longer periods of stay at camp.

TABLE I
MEDIAN P.F.I. SCORES

Number of Boys Tested	Length of Stay	Entering Median P.F.I.	Departing Median P.F.I.	Median P.F.I. Gain	Median % Gain
80	2 weeks	102.50	109.00	6.50	6.
28	4 weeks	104.00	125.70	21.70	20.9
12	6 weeks	89.00	116.67	27.67	31.
22	8 weeks	92.50	123.00	30.50	33.

The most striking revelation of these data is that a two-weeks' stay at camp is of relatively little benefit. Boys will gain nearly four times as much in fitness by doubling their stay. It appears, too, that the last two weeks add little in terms of physical fitness, but it may be that desirable physical habits and social attitudes and ideals become fixed during this period.

That great gains may be made even in two weeks seems to be indi-

[8] The P.F.I. is a measure of "capacity for activity." Norms increase rapidly for increase in weight. If body weight increases without a corresponding increase in strength, the P.F.I. testing and calculation reveal that the increased weight is chiefly fatty tissue or even colonic residue. Therefore, a gain in weight alone is not desirable. Of course, it is also not inevitable. Most boys gained in weight during their first two weeks, but their gain in strength was proportionate or greater, which is wholly desirable.

cated by Table II, though the chances are great that the boy who increased his fitness by 47 per cent in two weeks either did not respond properly to the first test, or was in unusually poor condition of a temporary sort during the first day at camp.

The various shadowgraphs and scattergrams tell an eloquent story of the effects of added weeks on campers' health. These graphic records, perhaps the first of their kind relating to summer camps, establish progress standards for future camp programs at Ousamequin. The

TABLE II
GREATEST INDIVIDUAL GAINS AND LOSSES IN P.F.I.

Length of Stay	Entering P.F.I.	Departing P.F.I.	P.F.I. Gain or Loss	Per Cent Gain or Loss
2 weeks	68	100	+ 32	47%
4 weeks	90	150	+ 60	66⅔%
6 weeks	88	132	+ 44	50%
8 weeks	84	142	+ 58	69%
2 weeks	112	100	— 12	— 10.7%

shadowgraphs are of particular interest since they show progress of the middle 20 per cent of campers rather than averages for all.

The line drawings showing variations between tests of campers remaining four or more weeks effectively demonstrate the errors of assuming (*a*) that most campers improve in health; (*b*) that improvement is regular; or (*c*) that it is automatic. The variations as between individuals are especially striking. These records establish beyond reasonable question the necessity of frequent testing and individual programs if camp objectives are to be achieved in fact: if camp organizers and sponsors are to justify their claims.

THE RESULTS—BY CALENDAR PERIODS

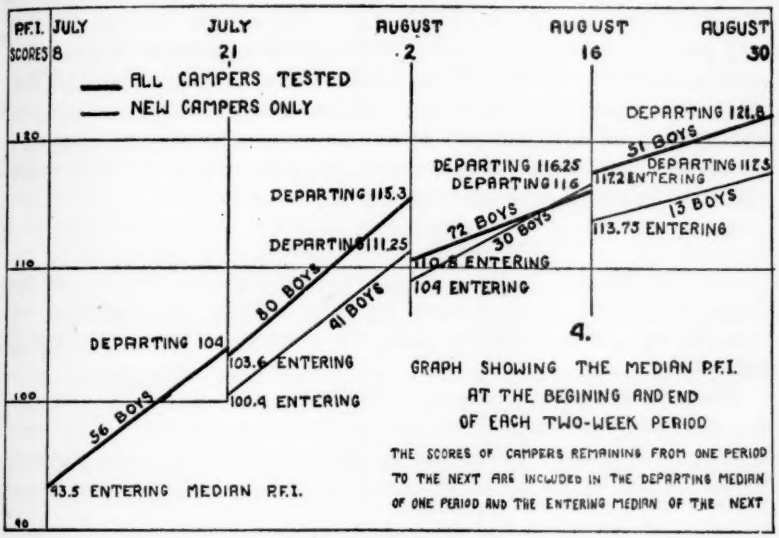
To seek a further explanation for the apparently numerous losses in P.F.I. by individual boys at the ends of certain periods, an analysis of P.F.I. changes was made according to calendar dates. We have previously considered the results solely on the basis of the *number of weeks* a boy remained in camp. If classified according to dates, might the data reveal either program deficiencies during certain periods or the effect of a spell of bad weather?

In this connection, see Graph 4. This graph shows how the median P.F.I. continued to rise throughout the eight weeks. These results seem to indicate that the program was about equally strong throughout the entire season.

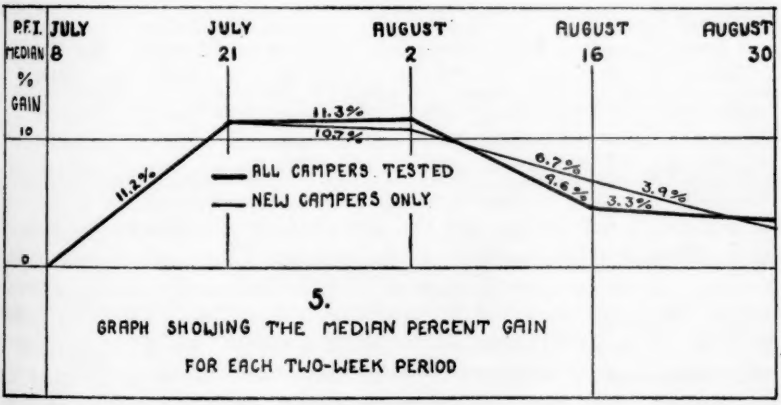
Another interesting fact is brought out on Graph 4, in comparing the scores of the new boys entering each period with those of all the boys tested at that time. It is surprising to note that the later in the

season the boys entered camp, the higher were their entering median P.F.I. scores. One might conclude from this that these boys had enjoyed programs fitted to their individual needs before coming to camp! Much research, however, will be necessary on this point before definite conclusions can be drawn.[4]

Graph 5 shows that the highest median per cent gain came at the end of the fourth week or in the middle of the camp season.



GRAPH 4



GRAPH 5

[4] For an investigation in a related field, see Arthur L. Jones' report, "The Effects of Various Summer Activities on Health." (Ed.).

The following reasons are advanced for the loss in the "median percentage of gain" beginning August 2:

1. Rain and cold weather from August 10 to August 16 interfered with the camp program and kept the boys indoors.

2. A let-down on the part of the camp staff occurred due to previous success.

3. The steady and great rise in the median P.F.I. from one period to the next made an increase in the median percentage of gain more difficult to achieve. This is also shown by the superior gain of the new boys over the boys who remained from previous periods. A somewhat involved analysis, too long to be detailed here, indicates that this loss began about July 28th, in which case the graph for the median percentage of gain would almost resemble a normal curve, showing that it is increasingly difficult to achieve a rapid gain beyond a certain point, which the writer places tentatively at 14 per cent.

TESTS MADE DECEMBER 29, 1934

To discover the effects of city life subsequent to camping on the Camp Ousamequin boys, forty-seven were retested on December 29, 1934 during a camp reunion. Note the surprising results reported in Table III.

Records of boys in schools, Y.M.C.A.'s, etc., reveal that, on the average, boys past twelve years old usually decline in P.F.I. from year to year, and particularly during the winter months. This is probably due to the lack of control of all phases of their lives such as are present

TABLE III

MEDIAN P.F.I. DEPARTING SCORES COMPARED WITH MEDIAN P.F.I. SCORES MADE DECEMBER 29, 1934

Number of Boys Tested	Length of Stay in Camp	Departing Median P.F.I.	12/29/34 Median P.F.I.	Median P.F.I. Gain	Median Per Cent Gain
27	2 weeks	107.5	113.13	5.6	5.2%
10	4 weeks	109.0	114.00	5.0	4.6%
10	8 weeks	124.0	124.00	..	....

in well-conducted camps, and the fact that the winter climate is not as health-stimulating as fairly warm weather. These forty-seven boys, however, do not, as a group, show any loss in their median P.F.I. scores.

The boys who remained in camp the shortest time gained the most in their median P.F.I. after they left. Of course, it would be harder—and inadvisable as well—for most of the eight-week boys to gain in the interim, since they had gained so much during the camp season. It is also important to remember that the eight-week boys were, in December, 10 per cent higher in physical fitness than the two-week boys, even though the latter had gained most. Thus, the relatively per-

manent effects of eight weeks camping (at this camp in 1934) were far more beneficial than shorter periods.

Since these boys come from all classes of homes and environments and attend many different schools, it would seem reasonably safe to suggest, subject to further investigation, that it has not been their program since leaving camp that has caused them to maintain during winter months their summer P.F.I.'s, as much as *the building-up process started in camp has carried over into the winter months.*

EQUALIZING TEAMS

The Strength Index was used to equalize teams for competition, instead of organizing teams on the basis of age, or as Juniors, Intermediates, and Seniors, as is often done. For example, the boys whose S.I.'s ranged from 500 to 749 competed in one league. Those with Indices from 750 to 999 competed in another league, etc. These divisions were also utilized for track meets, swimming meets, rowing races, and all individual competition. Heats were arranged so that boys of approximately the same strength competed against each other. Generally the camp was divided into six or eight classes for these competitive events.

Among many outstanding consequences of this program of equalizing competition, the following four are most significant:

1. At no time during the summer did a big boy—or any one boy—run away with the majority of the events, or did one team "clean up" a baseball, volleyball, or basketball league.

2. The boys were pleased, because they felt that they had equality of opportunity.

3. The athletic and swimming counselors were pleased because they had an objective means of arranging their classifications and no guess work when it came to arranging heats.

4. Arguments were eliminated.

5. The boys gained noticeably in social efficiency or citizenship. We wish there were objective methods for measuring these gains, for *the entire camp staff is convinced that, in our new programs, results are better in this important field also than in the old program which left health improvement largely to chance.*

"TWO-WEEK" BOYS

As shown in Scattergram A, of 80 different boys remaining in the camp for only two weeks, thirteen show a loss in P.F.I. between their entering and departing scores. Four others remained unchanged. The remaining sixty-three boys show gains.

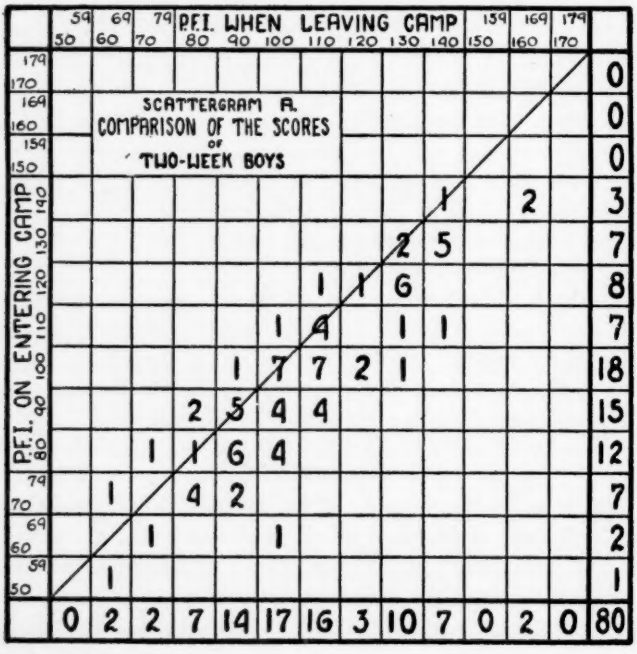
The greatest value of measurement resides in the uses made of results to modify subsequent procedures according to the individual needs revealed. Moreover, the values are greatest for those individuals who

have been benefiting least from the program. A brief analysis of several cases in which losses are shown is included here, to illustrate the uses of test results and the consequences of modifying boys' programs in accordance with revelations.

Of course, nothing could be done for the two-week boys: the second test came the day before they left camp. But the test did indicate their status, and explanations of losses are given below. It is particularly interesting to note the rapid gains in weight for many of these boys, since gain in weight is not indicative of improvement in physical fitness.[5]

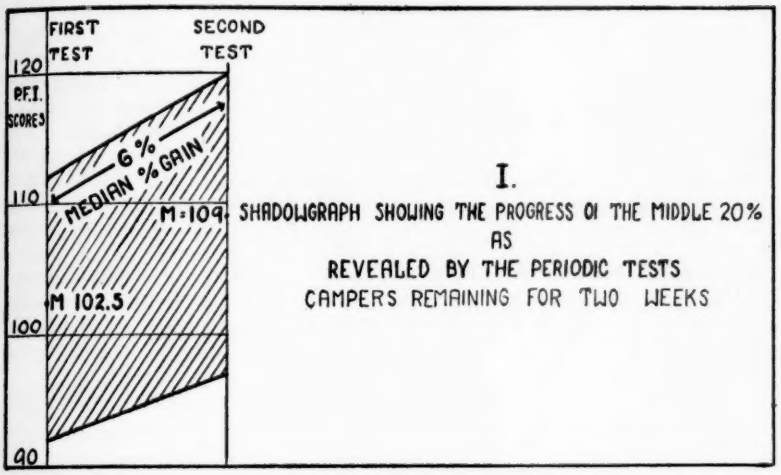
Case L.C.: (P.F.I. 93 to 84). A gain of 4 pounds in weight plus an unwillingness to be retested, one of the rare cases of this nature encountered. This boy was sent to camp by the Anti-Tubercular Association. His scores were reported to the officials responsible for sending him to camp, with the suggestion that he be watched closely during the fall and winter months. He reports that he has been free from illness since leaving camp and attributes his gain to the program laid out for him while in camp, and followed during the later summer months and fall. His activities this fall and winter have been those of a normal high school boy. Against his wish he was retested on December 29, 1934, and had raised his P.F.I. to 102.

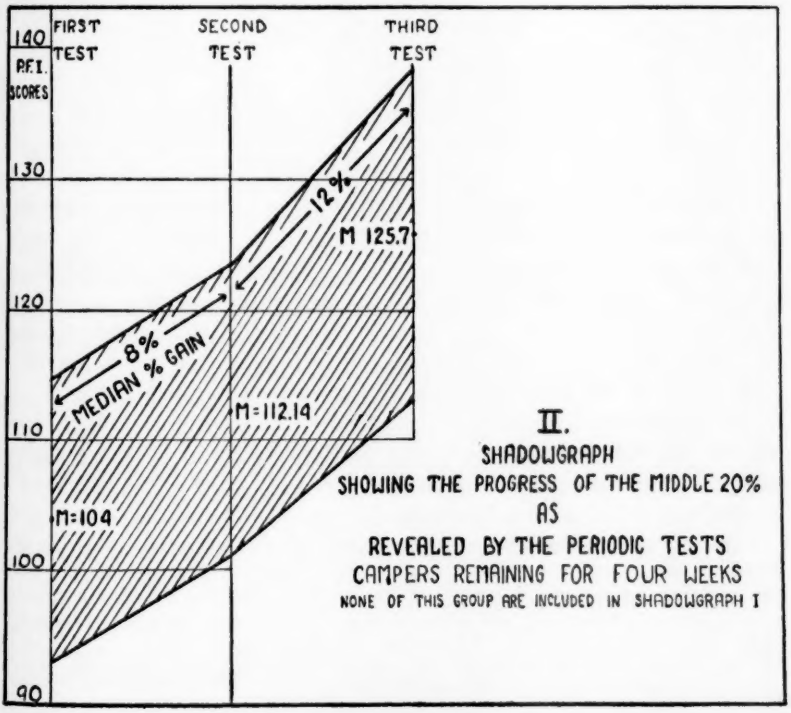
Case E.F.: (P.F.I. 75–68). A mental case sent to the camp by one of the dispensaries. His camp record was sent to the dispensary with the suggestion that he be checked closely during the winter months. He was retested on December 29, 1934, and made a P.F.I. score of 80. Inasmuch as his stay in the camp was from August 18 to September 1, thereby eliminating any building process which succeed-



[5] See Arthur L. Jones, page 146 and James A. Wylie, page 162.

SHADOWGRAPH I





SHADOWGRAPH II

ing summer weeks might have accomplished, is it probable that his gain since leaving camp is, in some measure at least, due to the care he received during his stay at Camp Ousamequin?

Case W.G.: (P.F.I. 123–118). Blisters on both hands due to rowing.

Case R.H.: This boy spent three days in bed with a cold. He lost in weight, in P.F.I. and S.I. In fact, he lost in everything but height. His parents and the school nurse were notified of this condition and asked to have the boy examined thoroughly by their family physician or else send him to a medical clinic. His reaction to a tuberculin test was positive. X-rays of his lungs, however, were negative. The school nurse reported, in November, that he had gained back the three pounds lost at camp plus two more, that for the first time in his life he was playing football and other games with the boys at school and in his neighborhood, and that while in the past he had needed constant prodding from his teachers to keep up in his studies, he was at that time leading his class. His parents, his teachers, and the school nurse believe that his brief stay in the camp, and particularly the special program of exercise, rest, and diet prescribed because of his low P.F.I., were responsible for this change. While in camp the boy seemed dissatisfied and reported that he did not like camp because he was made to exercise. Now he says that he really liked camp and wants to return next season.

Case H.L.: (P.F.I. 137-130). A gain of 4 pounds in weight plus a day in bed immediately previous to the second test.

The explanations of the four cases which remained unchanged are included below. It should be noted that these boys' gains in strength were just proportional to their weight gains.

Case C.D.: Gain of 6 pounds in weight.

Case J.L.: Gain of 4 pounds in weight.

Case C.Mac: Deep cut on the left hand at the time of second test.

Case S.R.: Gain of 5 pounds in weight.

"FOUR-WEEK" BOYS

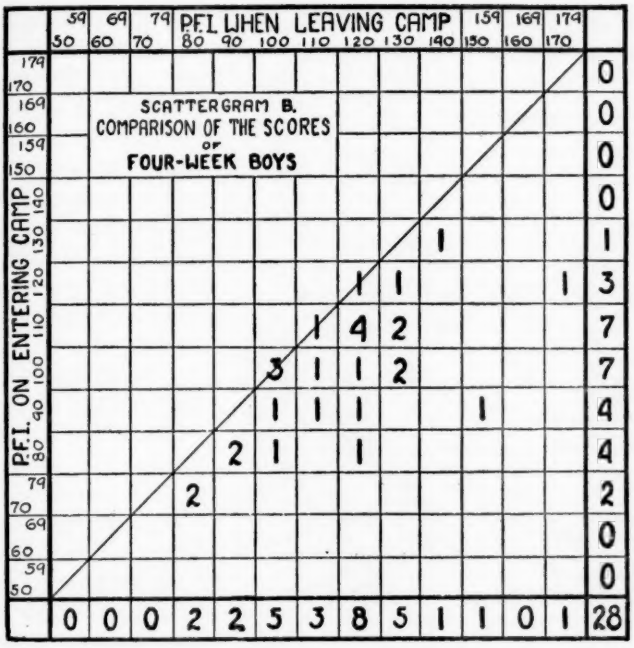
Referring to Scattergram B, which compares the entering and departing scores of the 28 boys who remained in camp 4 weeks, note that the gains were considerably greater than those made by the boys remaining 2 weeks. Here we have a percentage gain of 20.9 as against 6 per cent made by the boys who remained only two weeks. In the four-week group there was only one loss in P.F.I. (See Graph I.) This case—C.S.—is the last one discussed under the four-week group.

Shadowgraph II shows that the gain for this group was greater during the last two weeks than during the first two, but Graph 1 shows that, of these boys, only two lost in P.F.I. during their first two weeks in camp.

Case J.C.: Was nine years and five months old and attending camp for the first time. He experienced difficulty in adjusting himself to the camp life and program. Because of his P.F.I. loss on the second test, he was shifted to another cabin with a group of more congenial boys under a counselor whom he had learned to like. His gain of 14 points in P.F.I. during his last two weeks seems to prove that the shift was a wise one. When he was retested on December 29, 1934, his P.F.I. was 142, exactly the same as his score on leaving camp.

Case R.M.: Lost during the first 2 weeks because of an apparently too-rapid gain of 6.5 pounds in weight. Greater care was taken to be sure that he exercised regularly during his last 2 weeks bringing about a gain of 6 points in his P.F.I.

Graph 1 also shows that eight boys scored lower P.F.I.'s at the end of the fourth week than they had at the end of the second week. In only one case, however, did this loss bring the departing P.F.I. below the entering one.

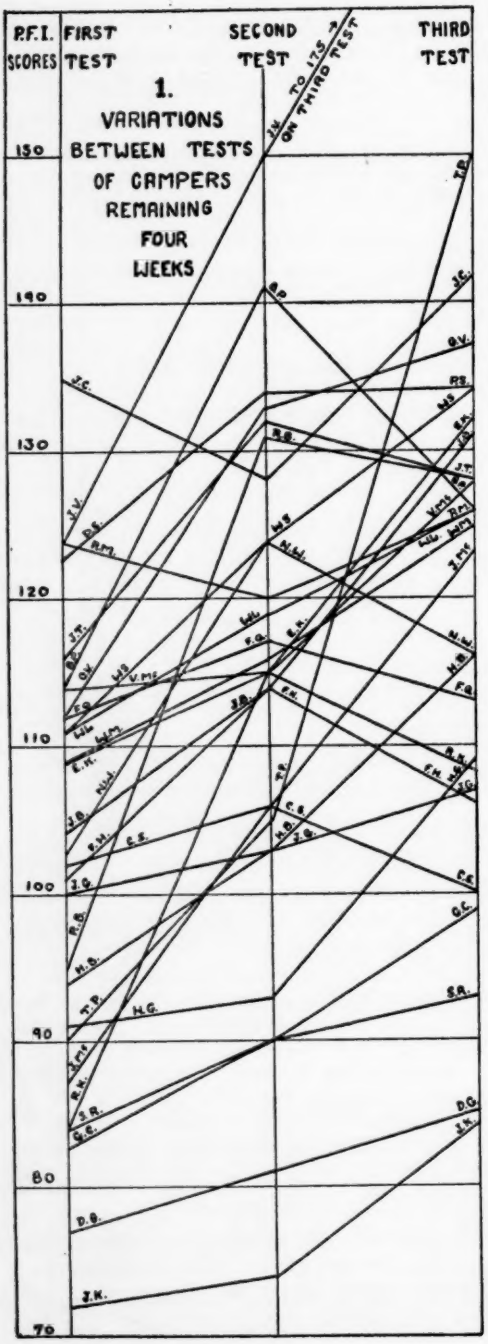


The losses of six of the eight boys may be attributed to the reaction from a too rapid gain in P.F.I. the previous two weeks and to a possible let-up in supervision of program by the camp staff because of the previous gains. The seventh boy's loss was due to a strained wrist which interfered with his ability to perform the test.

Case C.S.: Was sickly when he entered camp and needed rest, fresh air, and good food. He gained 4 P.F.I. points during his first two weeks. He was, however, confined to bed with a cold for 2 days previous to his third test which showed a loss of 6 points, thus leaving him with a final loss of 2 points for his stay in camp.

SIX-WEEK BOYS

Scattergram C compares the entering and departing scores of the twelve boys who remained in the camp for six weeks. The median gain is 31 per cent. No boys lost in P.F.I. *when the entering and departing scores are compared.* We find, however, as shown on Graph 2, that while all the boys showed a gain at the end of the first two weeks, four of them showed slight losses at the end of the fourth week when compared with the scores made at the end of the second week, and two



boys showed slight losses and two stood still at the end of the sixth week, when compared with the scores they made at the end of the fourth week.

Of the four losses at the end of the first month, two may be attributed to reaction to previous fast gains. Increased participation in games and boating resulted in advancing the P.F.I.'s again. A third boy had just returned from a two-day visit with friends. The fourth boy was handicapped on both his third and final tests by an infection on his right thigh.

The second of the two boys showing slight losses between the fourth and sixth week tests had spent two days in bed with a cold before taking the test.

Of the two boys whose scores remained unchanged, one had cut his hand in the shop and the other was in a period of mental unrest due to home conditions and his interest in the camp program had lagged.

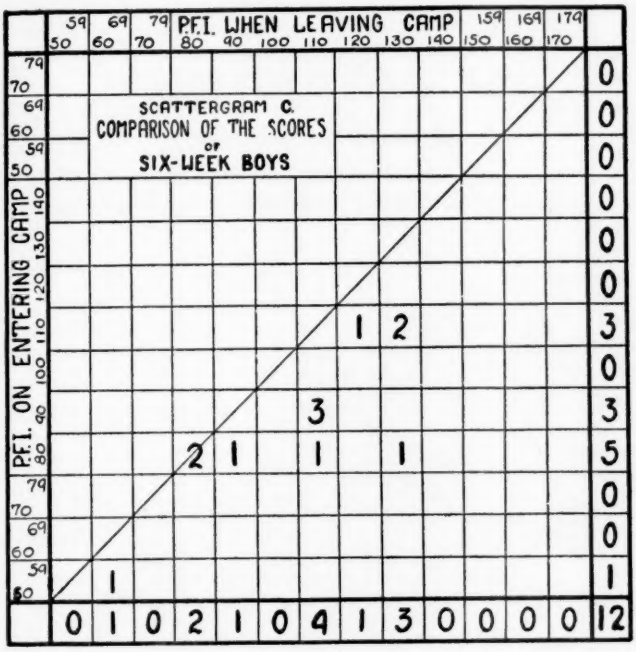
Shadowgraph III gives an interesting picture of the regular gain made by this group of boys throughout their stay.

EIGHT-WEEK BOYS

Scattergram D is a comparison between the

entering and departing scores of the twenty-two boys who remained in the camp for the full season, or eight weeks. As is also shown on Graph 3, only one boy, Case C.J., showed a loss between his entering and departing scores. This boy was not really a camper but part of the kitchen staff. His especially interesting case is discussed below.

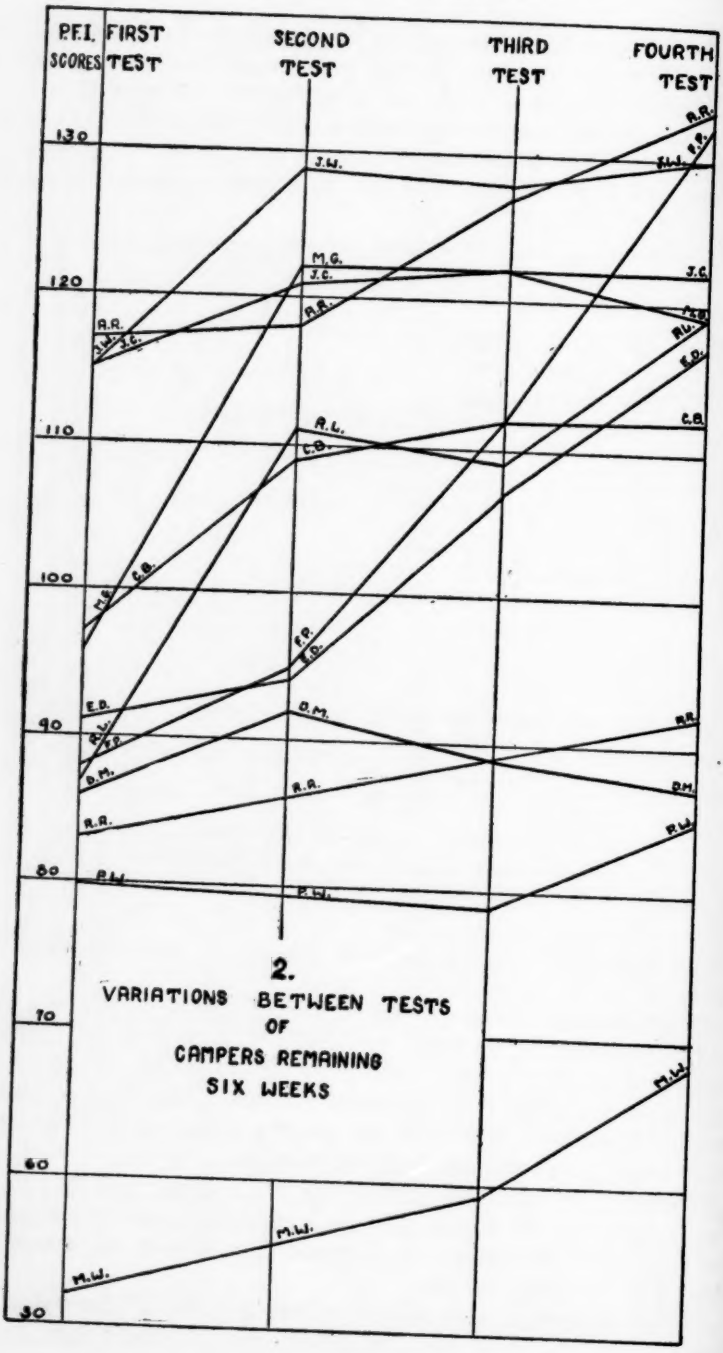
The median per cent gain for this group was 33, again demonstrat-



ing the fact that the longer the boys remained in camp the more they gained.

Shadowgraph IV shows the rapid median gain of 21 per cent made by this group during their first two weeks in camp and the steady but slight gain thereafter, with a quickening again the last two weeks. The rapid gain during the first two weeks was due to the close watch kept on these boys because of their low entering scores which ranged from 70 to 114. It was thought inadvisable to push the majority of these boys much higher after the gains of the first 2 weeks, and the program was designed to hold them steady. *In several cases a deliberate attempt was made to reduce the scores of certain boys since it was feared that they were becoming too "fine."*

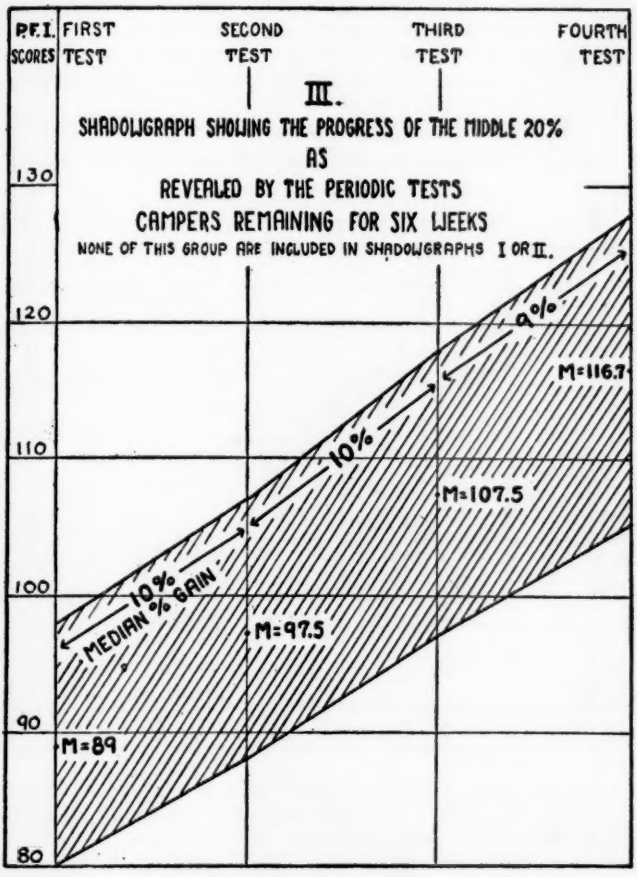
Three eight-week boys showed a loss in P.F.I. at the end of the first two weeks. Two of them had blisters on their hands from rowing.



2.
VARIATIONS BETWEEN TESTS
OF
CAMPERS REMAINING
SIX WEEKS

Case C.T.: This boy was a problem case. His entering P.F.I. was 71. He lost 2 points between his first and second tests. It was felt that he "just did not do his best"; also, he had gained 4 pounds in weight. During the next two weeks, in spite of an additional gain of 2 pounds in weight, he raised his P.F.I. score 8 points and continued to gain during the rest of the season. His departing P.F.I. was 93.

He was inactive and individualistic, preferring to stand on the sidelines and

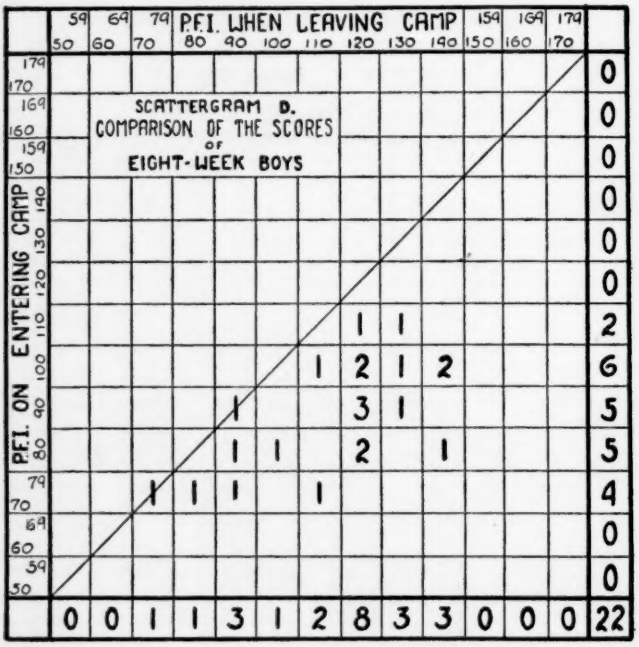


make wise-cracks at the players rather than play himself. After deliberately rowing out of bounds on two occasions during the first week, he was deprived of rowing privileges. However, rowing was prescribed for him along with hiking and swimming, at the beginning of his third week. No attempt was made at this time to coax him into team games. He was, however, always assigned to a team when the various leagues were formed. He began taking part in team games at the beginning of the fifth week. *It is the opinion of the counselors that his behavior improved as his physical fitness improved.*

Between the beginning of the third week and the end of the fourth week, six boys showed losses in their P.F.I. scores.

Five of these losses were undoubtedly due to a let-up in physical activity and gains in weight. Increased participation in various types of exercise to meet the individual needs resulted in increased P.F.I.'s on later tests.

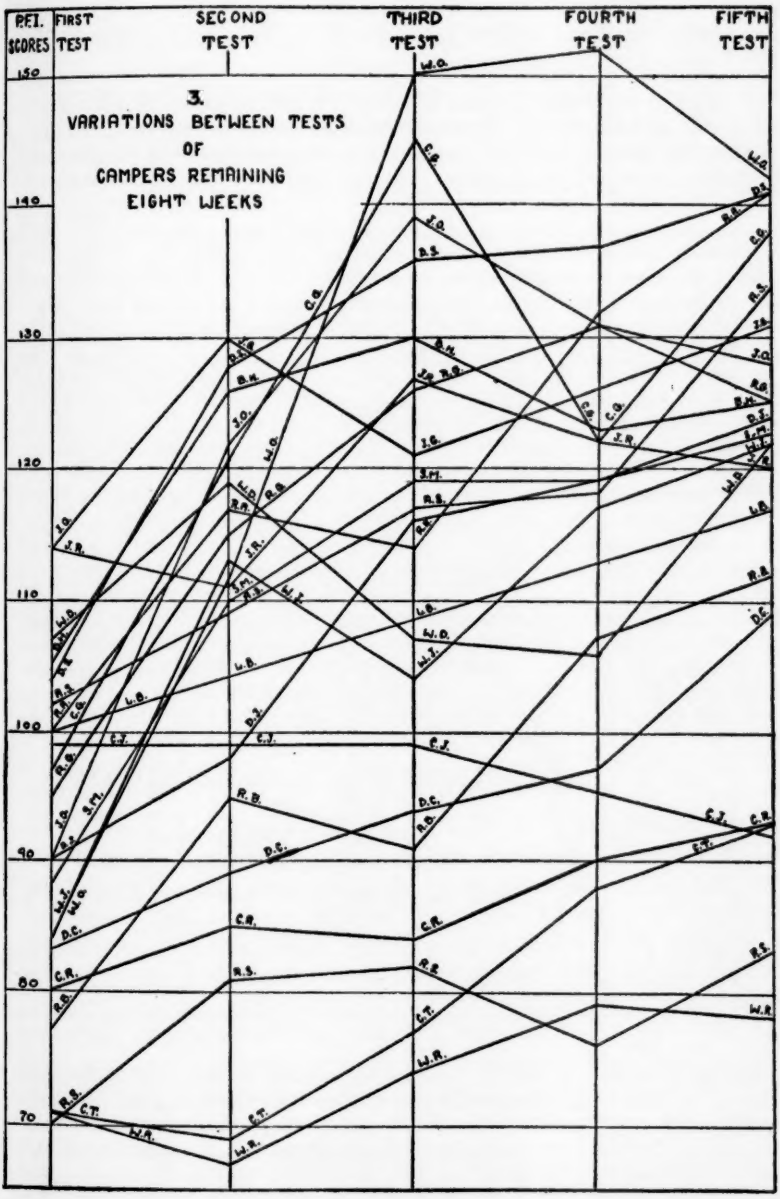
Case W.D.: Fifteen years old, he was a "lone wolf" and a problem boy. His only interest seemed to be in things mechanical. During his stay, he took an old victrola apart and tried to put the motor to other uses, finally taking it home with him. He enjoyed going off on walks by himself. He believed he was not as physically fit as other boys, and did not want to be tested in the beginning, because he said



	50	60	70	80	90	100	110	120	130	140	150	160	170	
170–179														0
160–169														0
150–159														0
140														0
130														0
120														0
110								1	1					2
100							1	2	1	2				6
90					1			3	1					5
80					1	1		2		1				5
70–79			1	1	1		1							4
60–69														0
50–59														0
	0	0	1	1	3	1	2	8	3	3	0	0	0	22

that he "would not do as well as the others." However, he scored 107 points and was happy. At the time of the second test, he again did not want to be tested, declaring that he "did not feel good," but finally admitted that he was afraid that he might show a loss. He was coaxed to try the spirometer and showed a gain. This led him to try the hand dynamometer, and he again showed a gain. After this demonstration of his power, he decided that he did not feel so badly and finished the test. His score was then 119, a gain of 12 points.

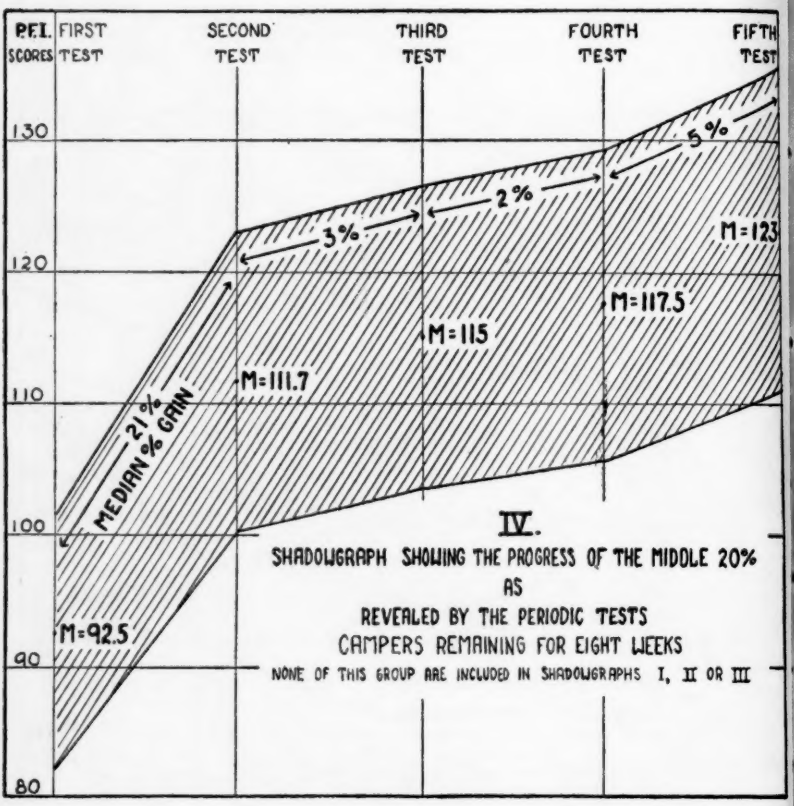
He was willing to be tested the third time, but unfortunately he lost four points on his lung capacity. This being at the beginning of the test, he immediately said that he was "no good" and proceeded to lose on each part of the test. The writer tested the boy alone two days later, making sure that he got a good blow on the spirometer. Due to better technique, he blew as much as he had on his second test, and immediately his attitude changed and he "guessed that he was all 'okeh' again," and proceeded to score 119 on the test. On his fourth test, the same incident occurred; he failed to blow as much on the spirometer as before, and consequently built up a state of mind that caused him to lose on all parts of the test. On his last


PET. SCORES
FIRST TEST
SECOND TEST
THIRD TEST
FOURTH TEST
FIFTH TEST
150
140
130
120
110
100
90
80
70
3.
VARIATIONS BETWEEN TESTS
OF
CAMPERS REMAINING
EIGHT WEEKS

test, the writer made sure that he got off to a good start on the spirometer, with the result that he did well throughout and scored 122 points.

At the beginning of the sixth week, six boys showed a drop in their P.F.I. scores for the previous two weeks:

Case C.G.: This boy, 10 years and 6 months old, entered with a score of 97. At the end of the first 2 weeks, his score has risen to 121 and to 145 at the end of the first month. It was believed that he was gaining too rapidly and a program of more shop work and nature study with less exercise was advised. Evidently his



IV.

SHADOWGRAPH SHOWING THE PROGRESS OF THE MIDDLE 20% AS REVEALED BY THE PERIODIC TESTS

CAMPERS REMAINING FOR EIGHT WEEKS

NONE OF THIS GROUP ARE INCLUDED IN SHADOWGRAPHS I, II OR III

exercise was cut off too abruptly, causing the loss of 23 points noted at the beginning of the sixth week. By allowing him to resume his previous program, he had raised his score to 138 by the time he left camp.

Case J.O.: Had a too rapid gain in weight during this period. Inasmuch as he gained in Strength Index, his loss in P.F.I. is of little concern. He had gained 49 points during the previous six weeks, so that this slowing up was probably a good thing in order to keep him from becoming too "fine" or "stale." Eight days later he fell ill and spent four days in bed with the grippe. Whether this loss at the beginning of the sixth week was a warning signal, we are not prepared to say.

Of the other boys, one was thoroughly discussed above, one was sick in bed the day before the test, another had cut his hand badly enough to interfere with his doing his best, and the last had become an assistant counselor and had spent much time working for his honor emblem, thus neglecting his athletic program.

At the end of the eighth week, five boys showed a loss in their P.F.I. scores as compared with those made at the end of the sixth week. These losses were similar to others previously explained, namely, blisters, sickness, or lack of exercise accompanied by a too rapid gain in weight.

Case C.J.: Previously mentioned as being the only loss in the eight-week group, when the entering and departing scores were compared, was 16 years old. He was taken on in the kitchen at the request of a social agency. They reported that he was undernourished and needed building up. During the previous spring he had been given free lunches at school. At the beginning of camp, his P.F.I. was 99. He did not take the test at the end of the first period. When tested at the end of the month, he again scored 99. He had, however, gained 4.5 pounds in weight and 93 points in S.I. He was not tested again until the end of the eight weeks when it was found that his score had dropped to 92. In the meantime, he had gained another 7.5 pounds in weight and 129 points in S.I.

It should be explained that, as a member of the kitchen staff, he was on duty only every other day, and took part in the regular camp program on the alternating days. His loss in P.F.I. was, therefore, a reflection on his exercise as well as his eating habits. He became fat and soft instead of heavier and "robust" or strong.

A particularly interesting case is that of D.C. who had been very ill before coming to camp. When he entered, his family physician specified plenty of rest and very little exercise. It was thought best, therefore, not to give him the physical fitness tests at that time. He was placed on a schedule of 9 hours sleep at night, an afternoon nap, and mid-morning and mid-afternoon lunches, with plenty of opportunity to be in the sunshine. He was tested at the beginning of the third week, when his P.F.I. was 89. Thereafter he participated in the regular camp program. He was tested at the regular two-week intervals for the rest of the summer, and had a steady gain in P.F.I. to 109 when he left camp. We estimate that his P.F.I. on entering camp was not over 75. His gain for the 8 weeks was, then, about 45 per cent.

We cannot close this summary without repeating that it reports the health objective and program phase of the 1934 Ousamequin Camp. The results were achieved without sacrificing the spirit of adventure and the joy of living. Other programs or adjustments to teach boys various sports, handicraft, campcraft, watermanship, and to develop the social and spiritual phases of their characters, were by no means neglected. Rather were these programs made more effective: *first,* because the boys' improved physical fitness enabled them to enter into more activities more enthusiastically; *second,* because other special adjustments were made to meet the needs of each boy for social development; and *third,* because the health testing and individual needs programs brought to the camp a new standard of accomplishment and a new technique for achieving results.

Part III

Equating Opponents in Sports

"It is not in the spirit of partisans, but of partners, that America has progressed . . .

"You and I acknowledge the existence of unfair methods of competition—of cut-throat prices and of general chaos. You and I agree that this condition must be satisfied and that order must be restored. The attainment of that objective depends upon your willingness to cooperate with one another . . . and to cooperate with your government . . .

"The Nation does not merely trust or hope that we will do our duty—the Nation is justified in expecting that we will do our duty."

—Franklin D. Roosevelt.

The Doctrine of Equality*

A GANG of boys "choosing-up-sides" preparatory to a sandlot baseball game has a profound symbolic significance: it dramatizes the instinctive desire of children to play with their equals.

In the absence of third parties (coaches, spectators, reporters, parents, etc.) children and animals truly play, even in formalized combat. Not victory is their object, but *the game!* Physiologically their impulse is to exercise muscles and senses; psychologically their urge is to overcome obstacles; reasonably their desire is to seek obstacles worthy of their mettle; sociologically their impulse is to seek more, and more intimate, contacts with other individuals of the same species. Methodologically their procedure is to divide into opposing groups of equal numbers (pom-pom-pullaway, run-sheep-run, football, baseball); or equal skills (mumble-d'-peg, marbles, tennis); or equal physical size (boxing, wrestling, football)—but always the ideal of equality is present in practice.

The outcomes of such contests include improved physical vitality, increased skill and knowledge, deeper insight into playmates' natures —and even one's own—and joy. Above all, joy—happiness—satisfaction, but satisfaction chiefly in the sense of increased control over environment through greater skill, deeper friendships and heightened awareness, rather than in personal triumph over the ego of a friend-in-play.

In the absence of rational guidance the tendency of the schoolboy sports seems, until lately, to have been away from equality-for-the-sake-of-joy to superiority-for-the-sake-of-personal-dominance. Joy-in-play was subordinated to striving-for-victory. This tendency was imposed from above—by coaches, principals, sport news, parents: in short, the "third parties." Left to themselves, boys and men in every walk of life and in every sport have always reverted and still do, to a striving for equality, a tendency which is charmingly manifest in the play of kittens or dogs: ***as soon as one clearly gains the upper hand, he relinquishes his advantage.***

Which alternative is more rational, the adjustment for equality or the struggle for superiority between friendly opponents in games? Which yields more lasting satisfactions? Which better develops skill and health and citizenship? Schoolmen ought to know. . . .

* This doctrine must be older than the hills. It has been restated in many ways and adapted in various forms by various groups. The ideal exists in one-design class yacht racing. Other discussions of this topic by the author of these comments may be found in *Physical Capacity Tests in the Administration of Physical Education*, 1925, Chapters I, III, VIII; *Test and Measurement Programs in the Redirection of Physical Education*, 1927, Part I; *The Amateur Spirit in Scholastic Games and Sports*, 1929, Chapter V; *Educational Objectives of Physical Activity*, 1929, pages 17–18; and *Fundamental Administrative Measures in Physical Education*, 1932, Chapter XII.

The following very brief analysis provides a theoretical answer to the problems suggested above. The succeeding reports of Part III provide exhibits relating to the application of theory to practice.

THE DOCTRINE OF EQUALITY

The doctrine of equality may be stated briefly thus: "In 'competitive' activities, educational objectives and the canons of fair play will be realized most completely only when the powers of opposing individuals or teams have been equalized."

The mere statement of this doctrine is sufficient to convince most persons of its validity; and certainly the latest trend, even in intercollegiate football, is definitely in the direction of active acceptance of the principle. *To prove the axiom—to accelerate this movement toward active and efficient equalizing of opponents—is the purpose of this part of the Supplement.*

In addition to observations and arguments printed elsewhere, the following general propositions are offered here. First, the foundation of friendship is equality, as was adequately stated by Cicero in his *Amicitia* when he urged as his fourth rule for friendship: *put yourself on a level with your friend.* Since the chief objective of play is joy in activity, and since joy is in direct proportion to one's identification of oneself with one's friends' purposes and joys, the significance of Cicero's adjuration is inescapable. The sportsman who would enjoy himself and give enjoyment to his friends in play will "put himself on their level."

Second, equality is at the heart of most of our modern political theory —particularly the "New Deal"—and even of many religions. Certainly Christians, above all, will endorse the doctrine. . . .

Third, many commentators lose themselves in a maze of conflicting concepts when they attempt to reconcile "equality" with self-preservation." The complete answer is contained in the biological fact that, in the long run, those individuals and species who survive are essentially and increasingly cooperators rather than competitors. But this is another story. Short of this philosophical entanglement it is significant to remind ourselves that school people believe survival, or at least good citizenship, comes through adequate or increased or superior health and social efficiency.

These qualities are definitely promoted by equality between opposing teams in sport.

OBJECTIVES SERVED BY EQUALITY

Among the educational objectives served by equality, social efficiency qualities stand out. These are initiative, courage, self-control, perseverance, honesty, justice, courtesy, cooperation, sympathy, loyalty.

Of these, it must suffice here to explain only two, say initiative and "fair play," which is the composite of honesty, justice, and courtesy. Let the reader imagine, now, two game situations. In one the opponents

are badly matched—the score is 60-0. Will initiative be greatly developed for winners *or* losers? Remembering that success and satisfaction are necessary to most learning, how can the losers be stimulated to initiate? Each new effort is met with overwhelmingly superior power and ends in disappointment, etc. Nor will the winners develop their initiating powers. It isn't necessary—any *old* method will do. Why experiment? And even if innovations are attempted and succeed, what is learned or proved? Victory would have accompanied almost any alternative.

But when opponents are approximately equal, initiative is promoted. For it is chiefly by initiating—experimenting—taking chances—that the deadlock is broken! Thus equality provides the very best conditions not only for stimulating initiative but for proving its value as well.

Fair play presents a different—a moral—condition. Of course, fair play is the essence of good sportsmanship. And the essence of fair play is that one is *just*—one refuses to give or receive special advantages to or from opponents. One does not kick one's opponents when they are down! Nor does one use twelve men against eleven men. It would be *unfair, unsportsmanlike.*

But *numbers* of players is a crude measure of power. Almost any football coach seeking victory would prefer ten strong men to eleven or twelve or thirteen weak men. Indeed, the aim of most football coaching and training is just to find and strengthen—and perfect the playing skill of—the largest men. Therefore, the educator interested in teaching good sportsmanship to his boys or girls refines his measures, the better to equalize the *playing powers* of opponents—the better to teach fair play. Indeed, in no other way can he really inculcate the essential habits and attitudes of fair play.

Similar explanations may easily be given by interested readers to show how equality protects health and promotes other social objectives. And of course joy in play is increased immeasurably, by reducing the differences between opponents, and even *proportionately* to the degree of equality achieved! Let theorists who exalt the value of joy in physical education take up the practical adjustment of equality between opponents and promote it with equal fervour! For talking about joy does not necessarily produce joy, but equalizing teams does. May we not even assert that talking about equality probably produces more joy than talking about joy?

Nor are the administrative advantages of equalizing opposing teams much less important. Emphasis on victory is lessened (for winning means, perhaps, only that teams are not equal!) which lessens the strain on referees, therefore the need of paying referees (so much). Interest in games increases, therefore players' attendance is more regular. Games are not forfeited. Discipline is self-imposed. The need of prizes, banners, trophies is reduced, even to nil. The joy of playing is enhanced, and the thrill of success is within the reach of all.

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METHODS OF EQUATING OPPONENTS

The educational and administrative values of equality emphasize the importance of using the best methods of equating opponents. "The more nearly equal the better the results," simply forces educators to seek the best.

However, "best" means "most useful, all things considered." A method which effected absolute equality but took longer to apply than to play the game would probably be less helpful, all things considered, than one which only approximated the ideal. The latter method might even be more useful, since it is better in practice to both win and lose than always to be tied. This eventually is effected by matching the same teams several times or in different sports.

Methods of equalizing teams which have been used by sports managers and directors include among others the following interesting list: setting age or height or weight limits or combinations of these, matching weights, setting total weight limit for teams, choosing up sides, selection of teams by coaches or directors or managers, establishing major and minor leagues, using school enrollment to determine eligibility for leagues, handicapping performers by distance or time or weight carrying, use of Strength Index limits or levels or averages, setting horsepower limits for automobiles, or piston surface or cylinder area; and, in yacht racing, setting limits of overall length, waterline length, draft, beam, freeboard, overhangs, sail areas, sail spreads, sail plans and the use of gadgets.

Of these, the most generally effective for schoolboy sports seems at present to be either the Strength Index or some other direct measures of strength. Of necessity this Supplement includes chiefly reports of experiments using the S.I. Doubtless there are other more valid measures; but perhaps there is none so economical, for the S.I. is determined quickly. A ten-minute period for the individual and "one-pupil-a-minute" for testers is sufficient. Moreover, the S.I. is available without further tests to all directors who use the P.F.I. for classification purposes in physical education. The effectiveness of the S.I. is attested in several of the succeeding reports.

However, the chief value of the following reports does not reside in their demonstration of the validity of any particular system of measurement, but in their demonstration that approximate equality may be and is effected in real situations as a routine procedure and is effective in increasing the efficiency of sports as educational programs and as means of enjoying sports.

Equalizing the Abilities of Intramural Teams in a Small High School

By H. Harrison Clarke and Harold A. Bonesteel

EQUALIZING the athletic abilities of individuals or teams is a recent innovation in intramural athletics which promises greatly to increase student interest in intramurals, develop desirable social qualities in participants, and solve many an administrative problem. The theory that educational objectives will be realized most completely and that the interest of players will be maintained for the longest period of time when intramural teams are evenly matched is sound educational philosophy. When teams are equal, players are more active, cooperation is essential, and initiative and courage are necessary requisites to playing the game "successfully." Particularly does increased interest in games, which equality guarantees, greatly reduce administrative difficulties. Attendance should be more prompt and regular; forfeitures should be fewer; discipline better; quarrels over officiating, victories, and prizes, should be fewer. The enthusiasm of players for their games should promote greater interest in the entire intramural program.

But some intramural directors avoid this function of *seeing to it* that opponents in games they organize are fairly matched. Sometimes they fear the work involved, or the conflicts with selfish or self-seeking fraternities. Sometimes they simply have not yet accepted the duty to insure fair playing conditions as one of their chief responsibilities.

This report, showing what can be done in small schools, should be reassuring to physical educators generally, but particularly to those who themselves serve in small schools.[1]

Since equalizing the athletic powers of opposing teams is a sound educational procedure, an objective method for determining these powers should be of considerable administrative service to the educator. This article reports the results of a study in which strength tests were used to equalize the ability of intramural teams. The experiment was conducted at Manlius High School, a small centralized school of 184 pupils located in central New York state.

PROCEDURES

The Subjects.—The subjects were sixty-six boys in the Manlius High School who were equated and placed on six teams of eleven boys each. Due to inability to schedule these teams for competition at the

[1] The various Albany reports reveal the values of equalization in large schools. See pages 202 to 226. (Ed.)

same time, it was necessary to form three groups of two teams each. All games conducted in the experiment were thus held between the two teams in each group. The results of the equating that follow should be interpreted with this grouping in mind.

The Tests.—Physical fitness tests were used to equate the teams—the "P.F.I. battery." It should be pointed out that there are at least two fundamentally different uses for these tests: First, the *Physical Fitness Index* is used as a measure of health or of general physical condition. Second, the *Strength Index* is used to determine general athletic ability.[2] Within the scope of this second use of the tests would come that of equalizing the athletic ability of competing groups. Therefore, the *Strength Index* was used to equate the intramural teams participating in this experiment. The results of this equating are found in Table I.[3]

TABLE I
EQUATING OF THE THREE GROUPS OF INTRAMURAL TEAMS ACCORDING TO THE STRENGTH INDEX

Designation of Intramural Teams	Strength Index	
	Mean	Standard Deviation*
Group I		
Team A	1392	347
Team B	1405	455
Group II		
Team C	1251	317
Team D	1351	336
Group III		
Team E	1334	300
Team F	1328	310

* S.D.'s are much larger than they should be. This condition was made necessary, however, by the small numbers of boys available.

The Sports.—After the opposing units in this experiment were equated, a series of games was held between the teams in each group. The sports used were touch football, speedball, field hockey, and indoor soccer. All of these activities were relatively unfamiliar to the players. Also, in order to eliminate a transfer of experience from football to touch football, the members of the varsity football squad were eliminated from the experiment. The factor of previous experience with particular sports was thus held fairly constant.

It should be definitely understood that the Strength Index is pro-

[2] This is correct for boys and men. For girls and women who engage in competitive sports the P.F.I. is the better equalizing measure. (Ed.)

[3] The Physical Fitness tests were administered by a group of physical education students at Syracuse University. These students had had considerable previous experience in giving these tests to high school and college students.

posed as a measure of *general athletic ability*,[4] and must not be conceived as measuring skill in any particular sport. An individual with high general athletic ability should perform well, or have capacity for good performance after a training period, in a number of activities. Previous experience, therefore, is a factor that is not fully controlled in a measure of general ability. The use of sports that are not well known by the subjects should, as a consequence, be a fair test of the S.I. especially as a measure of potential general athletic ability.

RESULTS OF THE EXPERIMENT

Results in Terms of "Victories."—This experiment of equating teams for intramural competition in touch football, speedball, field hockey, and indoor soccer, proved successful. The results of the games played between the equated teams were close, while many ended with tie scores. *It should be noted that, of sixty-four games played by all teams in the four sports, twenty-nine, or 45 per cent, were tie games.*

TABLE II

THE NUMBER OF GAMES WON AND TIED IN THE FOUR SPORTS CONDUCTED BETWEEN INTRAMURAL TEAMS EQUATED BY THE STRENGTH INDEX

Designation of Intramural Teams	Touch Football	Speed-ball	Field Hockey	Indoor Soccer	All Sports
Group I					
Team A—Games Won	3	1	2	2	8
Team B—Games Won	1	3	1	0	5
Tie Games	3	3	0	1	7
Group II					
Team C—Games Won	2	2	2	2	8
Team D—Games Won	2	1	1	1	5
Tie Games	5	4	1	0	10
Group III					
Team E—Games Won	2	1	1	1	5
Team F—Games Won	1	1	1	1	4
Tie Games	5	4	2	1	12

Results in Terms of Scores.—In Table III will be found the total number of points scored in each sport by the intramural teams participating in the experiment. The results of this tabulation again indicate the degree of equality of the abilities of the equated teams. The greatest scoring difference between any two teams for all four sports was eight points between Teams A and B, or 2.4 per cent of the total number of points scored by both teams. *The least difference was three points between Teams E and F, or .9 per cent of the combined score of the two*

[4] F. R. Rogers. *Fundamental Administrative Measures in Physical Education*, p. 135. Newton, Mass.: The Pleiades Co., 1932.

teams. Inspection of Table I will show that these latter two teams were the most evenly equated of any of the groups.

TABLE III

THE NUMBER OF POINTS SCORED IN THE FOUR SPORTS CONDUCTED BETWEEN INTRAMURAL TEAMS EQUATED BY THE STRENGTH INDEX

Designation of Intramural Teams	Games Played	Points Scored				
		Touch Football	Speed-ball	Field Hockey	Indoor Soccer	All Sports
Group I	20					
Team A	—	38	59	9	62	168
Team B	—	32	63	7	58	160
Group II	23					
Team C	—	56	45	8	65	174
Team D	—	56	45	9	58	168
Group III	21					
Team E	—	52	44	7	56	159
Team F	—	54	46	7	55	162

SUMMARY

In this study six intramural teams of eleven individuals each were equated in terms of the Strength Index. These six teams were arranged in three groups of two teams each, and a series of intramural contests was conducted within each group. The sports used in the experiment were touch football, speedball, field hockey, and indoor soccer. The results show that the games played between these teams were very close, that equating intramural teams with the S.I. is a satisfactory procedure for the small high school, particularly when previous experience of game skills is not an important factor.

Bonesteel, who conducted the games, noted that during the experiment no boy was absent from any of the games in which his team was scheduled to play, regardless of the fact that the boys were unaware an experiment was being conducted. From observation of the games, it was evident that all of the boys were enthusiastic and active participants. No disciplinary problems arose during the entire experiment. Each boy had a part to play in the games and felt a definite responsibility for his team's success.

This may be considered an excellent teaching situation from which desirable educational objectives as well as recreational pleasures should be realized.

Strength Testing Program Applied to Y.M.C.A. Organization and Administration*

By Harry Gordon Oestreich

Introductory Remarks.—The Young Men's Christian Association administers to the social, mental, spiritual, and physical needs of boys and men. The scope of its work is broad, both quantitatively and qualitatively; its field is the world, and its subject the whole youth.

This report is primarily concerned with the Association's physical department which carries on its manifold functions in the gymnasium. Here, at various hours of the day, groups gather for physical activity—young men, middle-aged men, and old men. Each individual has his own personal purpose for being in attendance. The youth faction craves invigorating, exciting, and stimulating recreational activity, while the older men long to regain their waning youth by refreshing and constructive indulgence in physical activities.

Each group, of necessity, needs to be treated in a different manner. Still more specifically, each individual making up the various groups has his own personal problems which must be met. These particular difficulties must be determined and adjusted by independent administrative measures, distinctive program content, and individualistic methods of procedure.

The Problem Specifically Stated.—This study aims to apply a strength-testing procedure[1] to Y.M.C.A. organization and administration of the "junior" and "high school" groups of its physical education program, and therefrom to determine the utility of this test as an objective measure to facilitate the attainment of the aims and plans of that department.

In an effort to attack the problem set forth above, the investigator set up experiments in the following fields and evaluated their resulting data:

1. Equalization of team competition by the use of the Strength Index and its implications to "Y" gymnasium work.
2. Diagnosis of pupil health status.†
3. Determination of degree of progress in physical fitness.†
4. Measurement of program.†

* This report is an abstract of the writer's Master's Thesis which is on file in the Boston University Library. The data and conclusions on equalizing teams are reported in this outline.

[1] Specifically, the P.F.I. test battery.

† Reported in the author's Master's Thesis but not included in this study.

5. Elimination of some of the evils of absences, and the ascertainment of new pupil relations.†

6. Determination of the degree to which strength tests facilitate classroom organization which is disrupted by the uncertain character of membership tenure.†

7. Maintenance of pupil interest in work by the use of a vital testing program.†

8. Study of posture by silhouettograph and strength scores.†

Site of Study.—The study was made at the Salem, Massachusetts, Y.M.C.A. where, through the interest of Mr. Charles Curtis, Physical Director, the classes were organized in terms of the experiment.

Testing Procedure.—The silhouettograph posture ratings and the various elements of the P.F.I. tests were given to all pupils comprising the "junior" and "high school" groups. Tests were given on Tuesdays and Thursdays, in the following order and by the following testers:

First day:	
1. Age	Given by a leader
2. Weight	Given by a leader
3. Height	Given by a leader
4. Push-up	Given by Mr. Curtis
5. Pull-up	Given by Mr. Curtis
6. Right Grip	Given by the writer
7. Left Grip	Given by the writer
Second day:	
8. Back Lift	Given by the writer
9. Leg Lift	Given by the writer
10. Lung Capacity	Given by Mr. Curtis
11. Silhouettograph	Given by a leader
Recording of scores:	By leaders

Subsequent re-examinations duplicated the details of the first test except that five boys completed their second test in but one period. The techniques followed in giving these tests as outlined in the manual, *Physical Capacity Tests*,[2] were closely adhered to.

Experimental and Control Groups.—The "junior" class was utilized as the control group where class method, program content, and administration remained the same as had previously been the practice in the department. Teams were organized by the "choose-up-sides" method, and squads were organized for apparatus work on the basis of the subjective judgment of the director.

The "high school" class was handled as the experimental group where the following changes were made:

1. A basketball league was formed wherein teams were equalized on the basis of the Strength Index.

† Reported in the author's Master's Thesis but not included in this study.
[2] A. S. Barnes & Co., New York, 1929.

2. The groupings for general skill work were made by utilizing the Physical Fitness Index.

3. More time was allotted to games and less time was devoted to calisthenic drills and marching tactics.

THE EQUALIZATION OF TEAMS ON THE BASIS OF THE STRENGTH INDEX

Preliminary Experiment.—An Initial League was formed by the writer by choosing teams which were equalized on the basis of the Strength Index. This league played 18 games. The scores of the games played were surprisingly close; incidentally, the first 3 games were ties. By consulting the following table the reader will note that in 61 per cent of the games the difference was no greater than 4 points, in 89 per cent of the games the difference was 9 points or less. The greatest difference was 13 points, while the median was 3.5 points.

In the difference of the average Strength Indices of the teams, each game taken separately, the team with the highest Strength Index won eight games, lost six, and tied four. Taking the games in which the strongest team lost, there seemed to be a tendency for the defeat to be more decisive the nearer the team difference approached equality.

Control and Experimental Groups.—Not having a comparative basis to evaluate the results of the first league, the investigator reorganized the group into two leagues: one, the Berry League, was made up of four teams equalized by the Strength Index scores, the other, called the Pick-Up League, consisted of three teams organized by the "choose-up-sides" method. This second league may properly be called the "control group" since the method used to equalize opposing teams was that usually followed in the Salem Y.M.C.A. Indeed, it is the method usually followed elsewhere; and many directors inexperienced in strength test techniques of equalization frankly prefer their subjective judgments to the results of standardized objective tests.

The Berry League played 26 games. The results very nearly duplicated the findings of the Initial League, the difference being in favor of greater equality for the Berry League. Seventy-two per cent, or 18 out of the 26 games played, ranged from ties to a 9-point difference. *Forty-four per cent, or 11, of the 26 total games were either ties or teams were separated by but 1 point.* Here the largest difference in team scores was 16, and the median was 3.4 points.

It is interesting to note how closely the percentages resemble each other in the Initial League and the Berry League. In both instances there is a significant tendency for the score to group toward the tie end of the table.

The Pick-Up League played eighteen games with differences in scores ranging from but a single tie to a thirty-point margin, the median falling on six points. Table I records a percentage study of these differences.

Conclusions and Inferences.—From the data gathered concerning the Initial League and the Berry League, in addition to their contrast with the Pick-Up League, the following inferences may be drawn:

1. The general existence of low score differences for league games in which equalization was secured by means of S.I. technique tend to show the superiority of the S.I. as a basis for equalization over the traditional "choose-up-sides" method. In terms of scores, the S.I. is twice as effective in equalizing teams as is the "choose-up-sides" method.

2. The fact that only one out of the forty-four games played by the two equalized leagues could not have been played under ordinary Y.M.C.A. gymnasium conditions demonstrates the practicability of the

TABLE I

COMPARATIVE SCORES OF BASKETBALL GAMES PLAYED BY DIFFERENTLY ORGANIZED TEAMS AND LEAGUES

Point Difference in Score	Initial League	Berry League	Pick-Up League
0 — 4	61%	72%	44 %
5 — 9	28%	20%	28 %
10 — 14	11%	4%	17 %
15 — 19		4%	
20 — 24			5.5%
25 — 29			
30 — 34			5.5%
	100%	100%	100 %
Median Difference	3.5 points	3.4 points	6 points

S.I. technique. It is, in fact, a method which can readily be adapted to variable elements, such as absences, program changes, or new member adjustments.

3. The superiority of the equalized league results over those of the Pick-Up League accentuates the value of the former.

4. The boys' interests were guided and directed in several ways by the new technique:

a) They were less interested in game scores and more interested in the games themselves. After several weeks of play, the boys ceased to ask about the scores or the standings of their teams in the league. The value of this phenomenon will be appreciated by players, who derive infinitely more joy from playing; by administrators, who must see in it a great lessening of disciplinary problems; by general secretaries, who will recognize that greater joy and fewer quarrels mean better satisfied members; by parents, who will have real evidence that their boys are growing up into good citizens.

b) At the conclusion of the experiment the boys asked if the spring and summer baseball leagues could be organized on the same basis of

equality. This request came unsolicited, and is perhaps the best evidence of the success of the experiment.

5. Team play developed much more rapidly in the equalized league; evidently equalization promotes the cooperative spirit as well as better basketball.

6. The fact that one team is slightly stronger in terms of strength than its opponent does not guarantee a victory for that team, for small differences may be overcome by other qualities such as leadership and team play. In fact, indications are that equalization tends to encourage such qualities.

7. A careful analysis of the games in which the stronger team was tied or defeated revealed that specific team strategy, cooperation, or some special skill was able to overcome the obstacles which were generally "within reasonable range."

SUMMARY AND RECOMMENDATIONS

Equalization of Teams on Basis of Strength Index.—1. Teams which are equalized on the basis of S.I. are equalized for activities which involve general athletic skill.

2. The scores of basketball games played by equalized teams were much closer than those of teams selected by the "choose-up-sides" method.

3. Team play developed more rapidly in equalized leagues.

4. The equality policy held pupils' interest more strongly than did the "pick-up" or "choose-up-sides" method; first, because the scores of the games were close; second, equality was not disrupted by absences; third, substitutions appeared fair to members because a definite policy was followed; and fourth, the boys recognized that they were part of a "scientific system," and psychologically their egos were stimulated.

5. From the viewpoint of the director, the disorganizing influences of absences and new members being added to the personnel were decreased immeasurably by the use of S.I. techniques. Organization and administration of class work became spontaneous.

Equating Opponents in Junior High School Activities

By Walter A. Cox and Kenneth B. DuBois

IN THE fall of 1932 a project of experimentation was started in Albany to work out a more satisfactory plan for grouping junior high school pupils in the various activities of the intramural program. The data recorded in the following reports represent the findings of this effort up to the present time. It is offered not as a finished piece of research but rather as an example of a cooperative effort on the part of our physical education staff members to seek out facts from which could be built a sound and forward looking program. The P.F.I. tests were used as the basis for this project because they had been used in Albany for a number of years to classify pupils in regular physical education classes. It was desired to use the data secured from these tests to improve and redirect the intramural program; and it should be remembered that throughout our five reports we used S.I. data from regular tests made each spring for purposes of P.F.I. classifications in required physical activities. Thus, S.I.'s were not as truly representative of strength-at-the-time-of-participation as they would have been if special tests had been given just before the experiments began. That results are as good as they are is a special guarantee not only that the S.I. technique is sound, but also that the intramural director need not engage in arduous pretesting of participants in sports; but only if, of course, P.F.I. tests are given to pupils as regular physical education techniques.

All members of the staff who work with junior high school pupils have been actively engaged in the project. It has been a cooperative undertaking from the beginning, with everyone sharing in the work of conducting the events and in the satisfaction of the success so far achieved.

The data included in the following reports have all been taken from our departmental records of the work carried on by the following members of our staff:

Ben M. Becker, John L. Blair, J. Edgar Caswell, Miriam F. Collins, John Dobris, Marjorie Dunn, Elizabeth Friend, Mary F. Garry, Louis D. Krouner, Ethel M. Lang, A. Burnette Lurass, Alice S. O'Hara, Margaret O'Rourke, Jane M. Riley, Elnora V. Seubert, Anna M. Sterling, Nathan Sutin, Charles S. Walker, and Mildred A. Wilson.

Equating Opponents in Junior High School Track and Field Events

By the Albany Physical Education Staff

THE BENEFITS to be derived from athletic competition should be available to every pupil in our schools. One fundamental prerequisite to the achievement of this aim must be the development of some plan to equate groups and individuals in order to secure equality in opportunity and participation.

The necessity and values of equality between opponents have been outlined elsewhere.[1] These focus attention on the problem of finding an equating measure which will be both sufficiently valid to guarantee fair conditions, and sufficiently economical of pupils' and teachers' time to render it practicably, as well as theoretically useful.

It is well known that speed of running is one of the most necessary qualities of a successful athlete in most sports. Other qualities are essential, too, so a simple running test may not be as broadly useful as a more general test. Nevertheless, running speed is so important that it was considered wise to check any equating device used by this criterion. Therefore, our first experiments were made with running races, and later with other sports.

In 1932 the Albany physical education staff planned a series of experiments designed to test out the utility of the Strength Index as the basis for grouping junior high school boys for competition in athletic activities. All pupils in the Albany schools above the sixth grade are given the Physical Fitness Test each year, so that Strength Indices for each boy and girl were readily available. The program called for experimentation with football, basketball, swimming, track and field, and ice skating. The first test was set up using certain indoor track activities. It was desired to test the procedure both for individual and for group effort. Hence we selected the fifty-meter dash and the shuttle relay. In the shuttle relay event each team consisted of eight boys with each boy running fifty meters. The boys running in the dash event were not to compete in the relay.

The next step was to determine just how the various competitive groupings were to be formed. After considerable experimentation, it was decided that equitable and convenient groupings would be secured by

[1] See the opening article of Part III of this supplement, and references there quoted.

using groups having a two hundred Strength Index point range. This was the basis for setting up the following divisions:

Group I	Strength Index under 850
Group II	Strength Index 850–1049
Group III	Strength Index 1050–1249
Group IV	Strength Index 1250 and up

As soon as the groupings had been determined the next step was to solicit entries. No limit was placed on the number of teams to be accepted in the relays. As plans for the meet progressed (the meet was conducted in connection with an annual indoor meet in the local armory) it became necessary, on account of a shortage of time, to restrict the fifty-meter dash to Group IV. After the entries had all been received, the meet was carefully organized in an effort to secure comparable conditions for all events. The same starter, finish judges, timers, and clerks were used for all events.

RESULTS OF THE FIFTY-METER SHUTTLE RELAY—FEBRUARY, 1933

S.I. Range	Group	Number of Teams	Number of Boys	Time of Winner
—— to 850	I	9	72	1 min., 7 sec.
850 to 1049	II	10	80	1 min., 4 sec.
1050 to 1249	III	6	48	1 min., flat
1250 to ——	IV	7	56	54⅜ sec.

These results showed a consistent improvement in the performance of the winning team as the Strength Index of the group went higher. The grouping plan used had been surprisingly successful in setting up groups which would include boys fairly equal in ability. Certainly none of the twenty-five teams in the first three groups would have won or placed had they competed in Group IV.

RESULTS OF THE FIFTY-METER DASH—FEBRUARY, 1933

Pupil	Strength Index	Strength Index Rank	Place in Trials	Place in Finals	Time Finals
Maffeo	2364	1	3	2	6⅘10
Liuzzi	2208	2	1	1	6⅖10
Di Lello	2149	5	2	0	
Hyman	1929	13	2	0	
Kelsey	1892	14	1	3	6⅘10
Timmons	1847	19	3	0	
Kolchetzski	1835	20	1	0	
Levy	1817	21	1	0	
Galloway	1798	22	2	0	
Luther	1704	26	2	0	
Lambert	1696	27	3	0	
Sax	1531	38	3	0	

A total of 41 boys competed in this event. In the final race the judges debated whether to award first place to Liuzzi or Maffeo, but finally declared Liuzzi the winner. This doubt in the minds of the judges indicates the closeness of the finish. It is interesting that the 2 boys, Liuzzi and Maffeo, having the highest Strength Index of the entire 41 boys, finished first and second in the finals. In the case of Kelsey, who ranked 14 in the Strength Index and finished third in the finals, evidently other factors overcame the handicap he had in strength.[2] Such factors might be running experience, skill in starting, or possibly a fortunate start in this race. An examination of the records of this group reveals that the Strength Index range was from 1453 to 2364 with a median of 1806.25. Eleven of the place winners, counting both trials and finals, were above this median, while only four were below it. In the finals all place winners were above the median.

The indoor track experiment was repeated in February, 1934, under the same conditions. The only changes made were that the fifty-meter dash was included for each group and the time of the first three places was recorded for each event.

RESULTS OF THE FIFTY-METER SHUTTLE RELAY—FEBRUARY, 1934

S.I. Range	Group	Number of Teams	Number of Boys	Recorded Time (Minutes, Seconds and Tenths) First	Second	Third
... to 849	I	8	64	1—13.4	(Not taken)	
850 to 1049	II	11	88	1—3	1—3.2	1—3.4
1050 to 1249	III	8	64	1—1.6	1—2.4	1—3.6
1250 to	IV	7	56	55 sec.	58 sec.	58.4 sec.

Here again, as in the 1933 test, the results show a consistent improvement in the performance of the winning team as the Strength Index of the group increased. Attention is directed particularly to the various times of these relays in the four groups. In all cases, except Group III, the time of the third place winner in the next higher classification is better than that of the first place winner in the preceding or next lower classification. In Group III the time of the second place winner is better than that of the first place winner in Group II.

These results clearly indicated an agreement with the conclusion of a year ago that the plan used was grouping runners to include boys fairly equal in ability. To test this finding still further, the average Strength Index for each team was computed. This was followed by a computation of the median Strength Index for the teams in each group.

[2] Readers should remember that no users or supporters of the S.I. as a measure of athletic ability imagine that it measures all of the factors which determine success. In fact, the generally accepted concept is that the S.I. measures accurately about half of these factors. Factors not measured directly or adequately (though correlations between these and S.I. are likely to be positive) are courage, cooperation, perseverance, initiative, experience, special skills, strategy, "competitive spirit," etc. (Ed.)

Using these data, the location of the place winners in each group in relation to the median of the group was recorded. The significance of this tabulation relates to the aim of "equalizing competition." If a great majority of winners in any race have S.I.'s above the median for their group, then the process of subdivision of participants into classes has not been accurate enough, and more classes with smaller S. I. range should be provided.

The results of the computations are given below:

		Above Median	*Below Median*
Group I	(only 3 places recorded)	2	1
II		2	2
III		2	2
IV		2	2

This analysis indicates that the range used for the groupings must be fairly accurate inasmuch as there was an even division between teams above and below the S. I. median for their group.

RESULTS OF THE FIFTY-METER DASH—FEBRUARY, 1934

Range	Group	Time in Seconds and Tenths		
		First	Second	Third
... to 849	I	7.6	7.8	8.
850 to 1049	II	7.1	7.3	7.4
1050 to 1249	III	7.	7.1	7.6
1250 to	IV	6.5	6.6	6.9

A total of 161 boys participated in this 50-meter dash in the 4 groups. Again the results showed a consistent improvement in the performance of the winners as the Strength Index of the group went higher.

A tabulation was also made of the place winners in each group in relation to the median of the group.

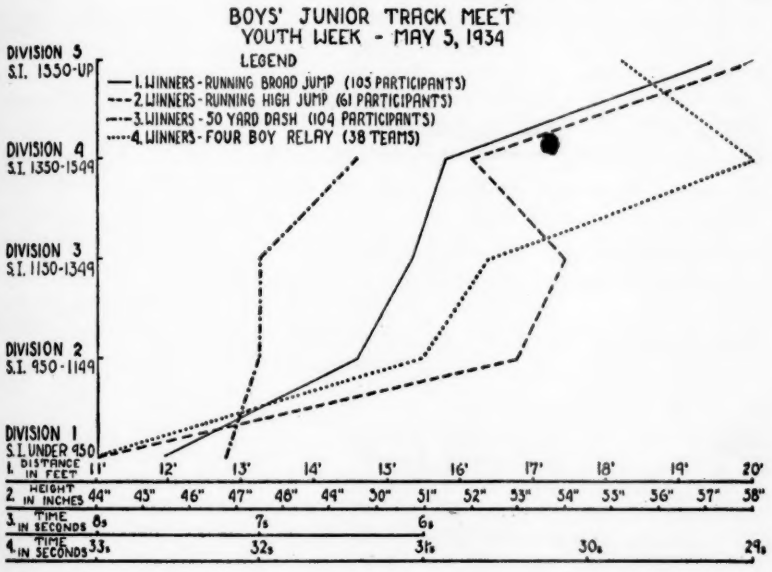
	Above Median	*Below Median*
Group I	9	10
II	9	10
III	11	5
IV	10	3

These figures included all place winners in both the trial and final heats. It is apparent from the above tabulation that the opportunity to win a place is approximately equal for a boy either above or below the median Strength Index of his group in all groups except Group IV. An examination of the records revealed that the actual Strength Index range in this group (1250 up) was from 1250 to 2196. Considering our previous results, it is almost certain that most of the place winners in any group with such a wide range will be found in the upper portion of the

group. This was what was actually found. These results indicate that equality of grouping will not be achieved if the range is greater than 200 Strength Index points. In our subsequent meets, therefore, possibly 6 groups will be provided in place of 4 used heretofore. This will enable us to include more boys in groups having a range of 200 points.

THE 1934 SPRING TRACK MEET

The first practical application of the experiments in track events was the 1934 track and field meet for junior high schools. This meet was conducted according to the general plans outlined for skating; and the results were approximately the same. Eligibility depended entirely



upon a desire to compete. No prizes were given, no arguments raised, no criticisms offered by school principals. Educational consequences to participants seemed excellent—at least, the first rule of good sportsmanship, approximate equality between opponents, prevailed.

The reader should note a few outstanding facts revealed by the experiments. The analysis is given below:

1. There were 489 entries in this meet, which was run off in less than 2 hours.

2. Five S. I. classes were provided instead of four as in previous experiments. This number may be raised to six in 1935. (In skating eight classes are provided.)[3]

3. Whether the event be running, broad-jumping, or high-jumping, the 200 S. I. point range seems equally effective in determining medians and limits of performance. The reader should note the steadily increasing quality of performance with each S. I. level.

[3] See the report of skating on page 212.

4. The same peculiar variation in performance for the next-to-the-top level was apparent in the 1934 meet as in track experiments and in other sports.

5. Physical fitness tests were given by regular instructors as part of their physical education programs to determine needs and classify pupils for later physical education activities. The high correlations between ability in track events and S. I. levels thus establishes several other facts:

a) Pupils do not malinger in tests to secure lower S. I. classifications for sports.

b) Therefore physical directors are completely honest in testing.

c) And testing at Albany is highly objective as well as valid and reliable.

6. It is particularly significant to note that occasional errors are reflected in results of athletic events. Thus, the first 2 boys finishing in the Class I 50-yard dash had been improperly entered in a lower classification. After the race their unusual times were noted and a recheck of S. I.'s was made, thus disclosing the administrative error. The same incident occurred in the Class I 220-yard relay.

7. The effect on performance of changing conditions of participation is indicated by the time for Class V 220-yard relay. Had it been run on the same track as was used for other events, there is little doubt but that the time would have been nearly a second faster. This course was laid out so that runners ran in the opposite direction, encountering quite different conditions.

Equating Opponents in Swimming

By the Albany Physical Education Staff

THIS report summarizes the results of aquatic activities in the 1934 Youth Week in the Albany Public Schools, showing the relations between Strength Indices and speed in swimming races. The results effectively demonstrate the validity of the S. I. as a measure of swimming ability, for use in equalizing competition in schools. Both median and fastest times for the various S.I. levels show this.

THE PROGRAM

A group of junior high school instructors was asked to serve as the committee to outline aquatic activities for the Youth Week (formerly Boys' Week) program. Since the track program was to be organized on the selective basis of Strength Index, the same procedure was recommended for swimming. It was approved and accepted. Incidentally, as far as was known by the committee, no other city-wide swimming meet had yet been conducted on this basis.

The following Strength Index grouping was set up to control both track and swimming activities for that week:

Division One	Strength Indices under 950
Division Two	Strength Indices from 950 to 1149
Division Three	Strength Indices from 1150 to 1349
Division Four	Strength Indices from 1350 to 1549
Division Five	Strength Indices from 1550 upward

The events contested were:

Division One:
- 20-Yard Free Style
- Diving for Form (three dives)
- 20-Yard Back Stroke
- 80-Yard Relay

Division Two:
- 20-Yard Free Style
- Diving for Form (four dives)
- 20-Yard Back Stroke
- 80-Yard Relay

Division Three:
- 20-Yard Free Style
- Diving for Form (four dives)
- 20-Yard Back Stroke
- 80-Yard Relay

Division Four:
- 20-Yard Free Style
- Diving for Form (five dives)
- 20-Yard Back Stroke
- 40-Yard Free Style
- 80-Yard Relay

Division Five:
- 20-Yard Free Style
- Diving for Form (six dives)
- 40-Yard Back Stroke
- 160-Yard Free Style
- 80-Yard Relay

TIME RESULTS

The time performances in each division in the various races were as follows:

Style	Division	Median Time	Fastest Time
20-Yard Free Style	One	14.6	12.3
	Two	13.8	11.5
	Three	12.7	10.5
	Four	11.6	11.0
	Five	10.9	9.7
20-Yard Back Stroke	One	20.0	15.0
	Two	17.2	15.5
	Three	15.5	15.0
	Four	16.0	14.6

(The 20-yard back stroke was not contested in Division Five.)

Style	Division	Median Time	Fastest Time
80-Yard Relay	One	60.4	56.0
	Two	59.2	54.1
	Three		48.0
	Four	50.9	48.7
	Five	47.4	42.6

ANALYSIS

In computing the following statistical data, 102 places were taken into consideration. There were 43 different races or events. The average number of contestants in each race or event recorded was 4.4. The median Strength Index was computed for the contestants in each of the five divisions revealing the following facts:

1. Forty-four places were won by boys whose Strength Index was above the median Strength Index for all contestants in each particular race or event.

2. Forty-seven places were won by boys whose Strength Index was below the median Strength Index for all contestants in each particular race or event.

3. Eleven places were won by boys whose Strength Index was the same as the median Strength Index for all contestants in each particular race or event.

In percentages this shows that 43.2 per cent of the places were won by boys whose Strength Index was above the median; 46.0 per cent of the places by boys whose Strength Index was below the median; and 10.8 per cent of the places by boys whose Strength Index was the same as the median.

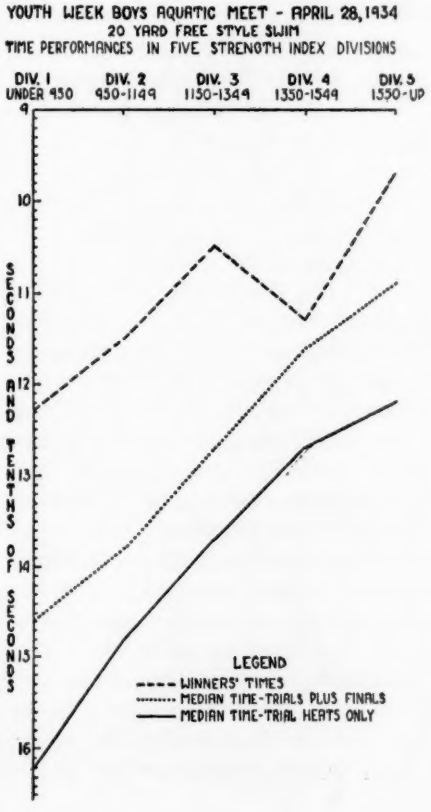
CONCLUSIONS

The findings here tend to show that in swimming strength has

an important bearing on winning. In previous analyses of swimming meets, in which a limitation of Strength Indices had not been imposed, it was ascertained that far too great a number of place winners were boys whose Strength Indices were above the median for the group. Limitation of space prevents the presentation of these former analyses.

In the results of the Youth Week meet, the place winners were about evenly divided above and below the medians for each particular group. The studies of track and skating have found this to be true also. In other words, when there is a selective basis of Strength Index, keeping all competitors within a very narrow S. I. range, the place winners tend to fall about evenly above and below the median. Furthermore, the attached chart indicates clearly the winner's time performance as well as the median time performance of the heat winners alone, and the heat winners plus the final winners in the twenty-yard free style swim. The median time performances improve with each higher classification.

In the light of these data, it is apparent that equality of competition may be obtained in intramural swimming by utilizing limited Strength Index ranges as the basis for grouping contestants.



Equating Opponents in Skating

By the Albany Physical Education Staff

THE POSSIBILITIES of conducting swimming, track, and skating meets according to the best educational theory are illustrated by procedures followed in Albany. This report outlines the conditions and results for 1933, 1934, and 1935 skating meets.

PLAN FOR CONDUCT OF MEETS

1. The key to the success of these meets (which attracted fewer than 100 actual participants before 1932, but 219 entries in 1933 and 437 entries in 1935) is the segregation of participants into 8 classes based on the Strength Index. The classes are as follows:

Under 750 S.I. points	1200-1349 S.I. points
750–899 S.I. points	1350-1499 S.I. points
900-1049 S.I. points	1500-1649 S.I. points
1050-1199 S.I. points	1650-above S.I. points

Scores from regular tests made in April-May of each year are used. The tests are given by regular instructors in each school, and are used primarily to classify pupils for physical education activities and to equalize competition in all sports conducted within each school.

2. Skating races are arranged in 8 classes for boys and 4 classes for girls. Races are in two distances—100-yard dash and 220-yard dash.

3. Both sexes participate in the same meet, though of course boys do not compete against the girls. The meet is usually run off in less than two hours, there being thirty different races including finals. Including each heat, about fifty actual races are skated. Of course, the participants in different classes do not compete with each other.

4. Pupils participating are excused from afternoon classes by special order of the superintendent of schools, on the principle that the meet is a proper "class activity." Pupils not participating are not excused: there is no "ballyhoo" or "build-up" for spectators.

5. All pupils in the city are eligible—from elementary school through the high school. There is no artificial eligibility by school or grade or academic record. Classification is according to Strength Index only.Thus it is not possible to use this event as a threat to force pupils to study in any other class—a proper arrangement, this, which should give pause to the usual academic eligibility rule maker. In Albany physical education and each other activity stands on its own feet. There is no more reason in disqualifying a pupil from participating in skating because his English is poor than in disqualifying him from participating in English because his skating is awkward!

6. No prizes of any description are given—whether cups, medals, banners, or even ribbons. *Pleasure of participation* is the all-sufficient "prize," which attracts more effectively than ribbons.

7. No team scores or school totals are computed. This innovation effectively checkmates one of the most valid criticisms of interschool participation on the junior high school level. Newspaper men would like to have these scores, but since the local school staff does not bother to make calculations, and since the computation would be decidedly involved, it is neglected by all!

8. The entire city physical education staff plans the meet under the guidance of the supervisory staff. Officials include the mayor as honorary referee, school officials, pupils, and interested laymen.

9. A complete program is mimeographed which includes the following items:

a) Entry forms.
b) List of officials.
c) Letter of authorization signed by the Director of Health Education and approved by the Superintendent of Schools.
d) Order of events.
e) Summary of results.
f) Complete official list of entries and heats to which they are assigned thus:

Event No. 2, Heat No. 1
Boys' 100-yard dash—750-899 S.I. points

Name	S.I.	School	Name	S.I.	School
1. Tibbetts, Edward	886	PS 16	7. Furlandi, Edward	844	PS 27
2. Heidrich, Fred	841	PS 18	8. Broadhurst, Wallace	895	L.J.H.S.
3. Rinaldi, Paul	844	PS 19	9. Schumacher, Jack	899	H.J.H.S.
4. Caldwell, William	842	PS 20	10. Hoffman, Edward	841	PS 20
5. Uhl, Edwin	809	PS 23	11. Kullman, Warren	897	PS 23
6. Weir, James	885	PS 26	12. Clothier, Alton	773	PS 26

10. Within a week following the meet, all records of winners, times, and other data are analyzed and reported to the Director of Health Education.

PUBLICITY

Formerly certain dailies questioned the absence of scoring, the classification of participants by S. I., the absence of prizes. However, the evident success of these meets, as measured by the numbers of participants and satisfaction of all concerned, has effectively eliminated adverse news comments.

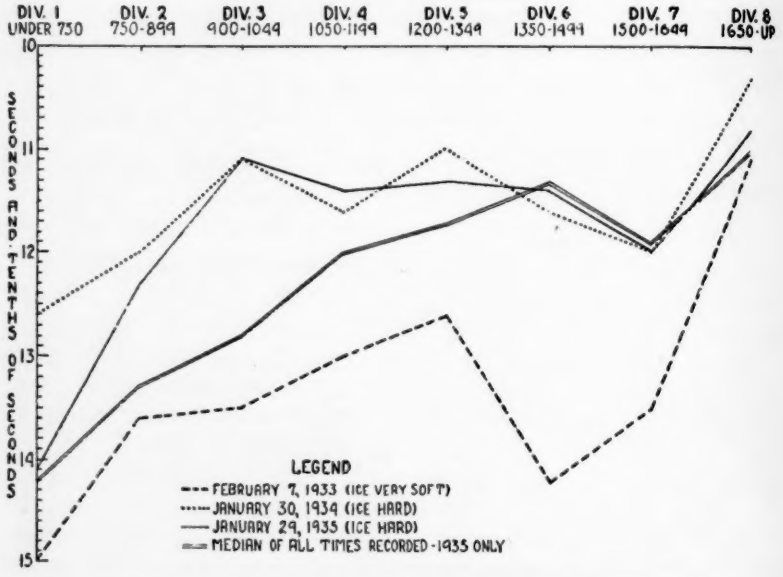
Newspapers now report the meet in advance and in detail, giving in full the list of events and entries—which often require several columns of print. The names of winners are also printed, but no "team scores" are included, for none are calculated. Critics of this procedure, who see in it a failure to develop "school loyalty," do not have the sympathy of Albany school principals who also see an end to competitive bickering, confusion, upset school routine, etc., in the new program. School loy-

alty, they observe, is developed more wholesomely and effectively by other means than "seeking to exalt the glory of ourselves by overwhelming our friends in sport."

As noted above, schools are not closed and spectators are not encouraged to attend. Of course spectators are welcome, and hundreds of parents and interested citizens attend these meets.

CHART I

BOYS' 100 YARD SKATING RACES
SHOWING TIME PERFORMANCE OF WINNERS IN 1933, 1934, 1935
AND THE MEDIAN TIME PERFORMANCE OF GROUPS IN 1935 ONLY
IN EIGHT STRENGTH INDEX DIVISIONS



EDUCATIONAL AND ADMINISTRATIVE RESULTS

The consequences of the new style of skating meet, which "equalizes competition," eliminates prizes, ignores school scores, neglects advertising ballyhoo, and brings together boys and girls from every grade above the sixth and every school building, include at least the following:

1. The numbers of participants have been more than quadrupled in four years. (In intramural basketball under the equality plan three hundred out of four hundred participate regularly and joyfully.)

2. The satisfactions of participants have been increased immeasurably. No skater feels beaten before he starts. If he loses, he knows he may win next time. He blames only himself for any failure, knowing his strength at least was equal to that of his opponents. If he wins, he is not unduly elated either—for he has achieved insight into the reasons for, and the tenuousness of, "victory." "Keeping a stout heart in

defeat and pride under, in victory" are merely silly phrases. "The game's the thing!"

3. All quarrelling over judges' decisions and bickering over prizes has ceased: the reasons therefore have been eliminated. The meet begins and ends in friendliness.

4. The meet is now accepted by superintendents, principals, and teachers as an intrinsically worth-while project—an educational experience.

5. All physical education teachers now think in terms of equalization. If strength is equalized, skill may be also. If not, the teacher knows that the deficiency is in skill or moral qualities and is led to correct deficiencies.

6. Conflicts between schools and physical education teachers have been eliminated. All work for the common good.

7. Parents endorse equalization, the meet, the entire physical education program, without reservation, for it provides every pupil in school with an opportunity to participate, to learn, to experience success as well as failure, to become more healthy and more social.

8. The physical educators of the city are giving a complete endorsement of every phase of equalization, non-scoring, and elimination of prizes. Most of them now press beyond minimum duties in testing, tabulation of records, analyzing of results, and requests for comments.

9. Principals now cooperate in very way, acting as officials, adapting their school programs to the needs of the meet and other special requests.

STATISTICAL RESULTS

1933.—In the 1933 meet, 16 different skating races were conducted, most of which of course involved several heats and a total of 186 participants. The S.I. classes were as indicated on page 214. In the 100-yard dash the winners' times for 8 classes were 15, 13.6, 13.5, 13, 12.6, 14.2, 13.5, 11.0. It is particularly interesting to note that the 1500-1649 S. I. point class was much slower than even the 1050-1199 class. This exception seems to run through the entire program of sports in which opponents are equalized in Albany. The only explanation so far offered is that this group happens to be in the full tide of adolescence and therefore is unusually erratic in physical functioning. However, no analysis in terms of pubescence has yet confirmed this hypothesis.

Observers gave the following analysis of the 1933 meet:

Leaving events 8 (100-yard dash for boys with S.I. above 1650) and 16 (220-yard dash for boys with S.I. above 1650) for separate consideration, because in these events the S.I. range is so great, we find that 20 boys above the median for their own group placed and 19 boys below the median placed. The average S.I. range for these 10 groups is 115.1.

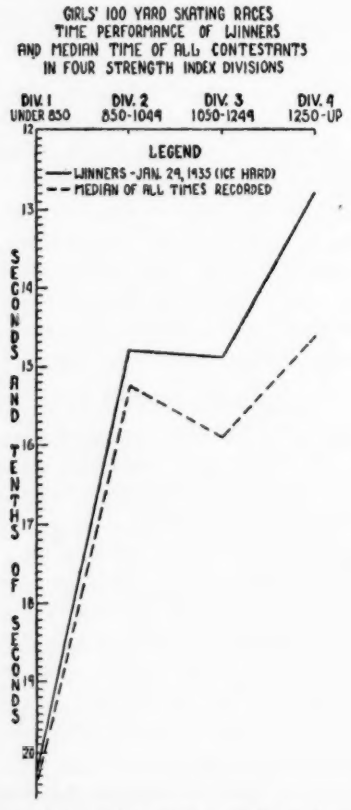
From this particular experiment, in which the range was no greater than 145 S.I. points, and the average range of these ten groups was 115.1, we found the opportunity for winning a place about equal for the boys whose S.I. was above or below the median for the particular group. At least the ratio was as 20 is to 19.

Consideration of events 8 and 16 discloses the following facts: The actual range for event No. 8 was 456 S.I. points, while for event No. 16, it was 649 or an average range of 552.5 points. Now in these two events 7 boys who won places in the races have an S.I. above the median and only 1 boy who rates below the median.

In the light of these facts we may conclude that a boy whose S.I. fell below the median had only about one chance in eight of winning a place in these events. Evidently a wide spread in range caused a much lessened opportunity for place winning for those below the median.

An examination of the time performances of winners of the various classifications in the 8 boys' 100-yard dashes strongly indicates that the higher the S.I., the better the time performance. This premise holds true for events numbering 1, 2, 3, 4, 5, and 8. In events 6 and 7 the time performance was not so good, but it must

CHART II



be noted that the number of participants in each of these events was less than the number engaged in any one of the other events.

A consideration of the time performances of the winners of the 4 boys' 220-yard dashes shows that in three of the four events, the higher the S.I., the better the time performance. In this case the premise is true for events 13, 15 and 16. The winner in event 14 gave a poorer time performance than the winner in event 13. It should be recalled, however, that the 220-yard dashes necessitated the making

of one turn during the races whereas all the 100-yard dashes were conducted on a straight-away track. Skill on the turns in skating races is a factor that cannot be ignored. But in spite of the part skill plays, we are still confronted with the fact that in three of the four 220-yard dashes for boys, the higher the S.I., the better the time performance.

1934.—In 1934 the skating meet experiment was repeated. One hundred eighty-seven entries actually skated on a very cold day. Again the times of winners in each class showed that the S. I. is a highly valid as well as a convenient measure of skating ability for boys and girls in their teens.

In the 8 classes for boys' 100-yard dash the times were 12.6, 12.0, 11.1, 11.6, 11.0, 11.6, 12.0, 10.3. For the boys' 220-yard dash, times were 26.2, 25.3, 26.0, 23.0. For the girls' 100-yard dash, they were 15., 14., 14.1, 13.8.

Observers' comments for this year were as follows:

In the boys' races we find that the classifications by narrowed Strength Index ranges resulted in twenty-one boys above the median for their classification winning places in the races while twenty-three boys below the median were place-winners. This result seems to indicate considerable success in equalizing competition.

Attention is directed to Event No. 8 (100-yard dash for boys) where the S.I. range was 1656–2009 and the median 1757.5 S.I. points. In this race all 4 place-winners were above the median. Last year we found 3 of the 4 place-winners in this class to be above the median S.I. for the class. Combining the results of the 2 years, we find 7 of the 8 place-winners were above the median.

In Event No. 16 (220-yard dash for boys) only 5 boys skated this year. Three place-winners were selected. The range was 1765-2009; the median was 1825. One boy above the median won a place and 2 boys below the median won places. Last year 10 boys skated in this event and all place-winners were above the median for the group. Combining the results of the 2 years we find 5 of the 7 place-winners were above the median S.I. for the group.

It would seem that a range difference of three hundred or more S.I. points is too great a handicap for equal opportunity to win a place in a skating meet. To state these facts in another way, it appears when any S.I. classification scheme consistently results in four-fifths of the place-winners being above the median S.I. for that group, that the classification is too broad for equalized competition. Unfortunately, the limited number of entries makes difficult further refinement of the S.I. range for this particular group.

Girls' Races

In the girls' events, Nos. 9, 10, and 11, we find three place-winners above the median and six place-winners below the median. Last year in these same events we had five place-winners above the median for each group and six place-winners below the median.

In event No. 12 with a range of 1264 to 1780 we find 2 place-winners above the median and one below. Last year the judges selected 4 place-winners and we had 3 above the median for that group and 1 below. For the 2 years the ratio is five to two.

It is, therefore, indicated, as in the case of the boys, that the S.I. range for the strongest group is too wide to insure equal competition in this grouping.

Time Performance

Time performances of the winners in both boys' and girls' races, while not con-

sistently better with each higher S.I. classification, nevertheless show a decided trend toward improvement in most of the classifications.

This year five of the eight and last year six of the eight winners in the boys' one hundred-yard dashes indicated time performance improvement as the S.I. classification went higher.

In the boys' 220-yard dashes this year 3 of the 4 winners turned in a bettered time performance with the higher S.I. classifications. Last year we found the same result.

This trend is further borne out by the results in the girls' one hundred-yard dashes for the two years. Each year 3 of the 4 place winners turned in improved time performances as the S.I. classification went to a higher level.

This cumulative evidence points decidedly toward the conclusion that the S.I. classification is equalizing the competition within certain ranges for even such a specialized activity as ice skating races, and should be further utilized until a better method of classification is discovered.

1935.—The 1935 skating meet attracted 294 participants.

Chart I indicates the relation between S.I. and times for various classes.

Equating Opponents in Intramural Track and Field Activities

By the ALBANY PHYSICAL EDUCATION STAFF

THE TENDENCY of junior high school physical education programs to concentrate on intramural activities raises the problem of classification. Obviously, homeroom, hobby, church affiliation, and other mental or social categories will not insure any reasonable degree of equality between opponents.

This report shows how the Strength Index may be used to equate opponents in intramural track and field events. Pupils in each school grade or homeroom may join forces by participating in events for individuals of their own S.I. level. Thus, the number of events or games (as in basketball) will be multiplied by the number of S.I. levels provided. Approximate equality will be guaranteed, which greatly enhances the attractiveness of the program, drawing many times more pupils into participation as well as providing a better controlled learning situation.

But is such a scheme *practicable?* The following report from an experiment conducted in the Philip Livingston Junior High School, Albany, New York, in 1934, is definite evidence of practicability, both in terms of equality and in terms of success in attracting and satisfying large numbers of pupils.

THE PLAN

1. One hundred forty-eight reported for the first track meeting. The group was divided into six divisions based on the S.I. derived from tests made in March. The meets were conducted in April, May and June.

TABLE I

Classes	*S.I. Range*	*Number of Pupils*
Division I	Under 950	14
Division II	950 — 1149	29
Division III	1150 — 1349	22
Division IV	1350 — 1549	22
Division V	1550 — 1749	29
Division VI	1750 and over	32

2. These six divisions having been made, they were further divided into four teams, each team having an equal number of members from each of the six divisions. The teams then selected the names: "Harvard," "Yale," "Army," and "Navy" and captains were elected.

To illustrate the procedure the complete roster of the "Harvard" team is given in Table II.

TABLE II

TEAM LIST INTRAMURAL TRACK LEAGUE

Harvard—E. Timmons, Capt.

	Division I	Grade	S.I.
1.	R. Gomez	9	863
2.	F. Caenssley	7	826
3.	W. Broadhurst	7	855
	Division II		
1.	J. Dorsey	9	1149
2.	R. Vogel	7	1049
3.	D. Bucci	9	980
4.	T. Small	8	973
5.	J. Van Wormer	7	1118
6.	W. Hoyt	7	950
7.	S. Vasiewicz	7	1140
	Division III		
1.	J. Tortorice	8	1308
2.	E. Nicklas	7	1156
3.	R. Rosenberg	8	1305
4.	W. Boule	8	1243
5.	V. Fake	9	1224
6.	E. Barnett	9	1316

	Division IV	Grade	S.I.
1.	F. Cameron	8	1377
2.	E. Larkin	9	1507
3.	L. Collier	7	1456
4.	S. Myers	7	1500
5.	J. Ornoski	9	1485
	Division V		
1.	J. Heinz	9	1680
2.	F. Day	9	1612
3.	M. Diamond	9	1593
4.	A. Adams	9	1604
5.	F. Bartholemew	8	1566
6.	J. Jimpson	8	1580
7.	C. Swirzcky	9	1688
8.	J. Drzsmala	9	1730
	Division VI		
1.	E. Timmons	9	1680
2.	G. Promiscuo	9	2050
3.	H. Wickert	9	2706
4.	I. Cornall	7	1807
5.	C. Pollay	9	2171
6.	W. Goldwine	8	1839
7.	A. Linett	9	1798
8.	W. Lindheimer	9	2152

3. A group of events was then selected for each S.I. division, the events being selected to conform to the capacity of participants.

TABLE III

EVENTS USED IN VARIOUS DIVISIONS

Events	Divisions					
	1	2	3	4	5	6
1. 75-Yard Dash	x	x	x	x	x	x
2. 100-Yard Dash				x	x	x
3. 220-Yard Dash				x	x	x
4. 880-Yard Run					x	x
5. 8-Lb. Shot Put				x	x	x
6. Pole Vault				x	x	x
7. Running High Jump	x	x	x	x	x	x
8. Running Broad Jump	x	x	x	x	x	x

4. Each member of the squad was permitted to participate in one track and two field events in his respective division.

5. A league schedule was then prepared for the four teams. When two teams met, the six divisions on one team competed with the six corresponding divisions of the other team, i.e.:

Division 1 of Harvard vs. Division 1 of Yale
Division 2 of Harvard vs. Division 2 of Yale

6. Points were awarded for the first four places (5-3-2-1) and points for all the events in all six divisions were added for each total team score. This plan made possible three days of meets for each week. Each team competed in two meets a week.

7. Practice sessions were held for the entire group over a three-week period prior to the first meet, which was conducted on April 25.

GENERAL RESULTS

1. Eight days were set aside for meets and 20 days for practices. Starting with an original registration of 148 boys there was an aggregate attendance of 2133 boys and a daily average of 58 boys. Six league meets were held, one All-Team Meet, and one Youth Week Meet. One hundred sixty-eight boys competed in the All-Team Meet and 147 boys in the Youth Week Meet.

2. Eighty-four different boys enjoyed the satisfaction of winning first places.

3. The method employed in this intramural set-up of equalizing opponents, providing for team loyalties, practice periods, the formality of "real meets" and for multiplying opportunities for success, practically guaranteed each participant an equal opportunity to achieve a place in one or more meets and to enjoy himself in participation.

4. A great amount of team loyalty was present throughout all the divisions. It was a common experience to see and hear youngsters from divisions 1 or 2 on one team cheering and encouraging their team members up in division 6.

5. An increasing interest is indicated by the consistency of the attendance records. *There were more boys participating in the last few meets than in the first two meets.* This is contrary to the experience of most intramural directors, who have been led to expect a falling-away of interest as the season progresses.

6. Each team competed with the other three teams once. At the termination of the league, an All-Team Meet was held at Ridgefield Park on June 1. This final intramural meet was open to anyone who desired to enter and it became necessary to add an additional team, totaling five in all.

7. The league was tremendously popular with and gratifying to a great number of boys.

8. An interesting sidelight of this league is the fact that the winners of many events in one meet did not win the next meet. In the All-Team

Meet two undefeated boys were defeated by comparative unknowns in our school track work.

STATISTICAL ANALYSIS

1. A complete analysis was prepared for place winners giving times and S.I. Table IV is but one of twenty-three such analyses. It is reproduced here to illustrate the procedure followed and the facts revealed in the competition.

TABLE IV
DIVISION II—950–1149
75-YARD DASH

Meet	*First Place* S.I.	Time	*Second Place* S.I.	Time	*Third Place* S.I.	Time	*Fourth Place* S.I.	Time
1	1043	10.	1112	10.3	980	10.4	1094	11.1
2	1126	10.1	1119	10.2	1084	10.3	1088	10.4
3	1140	12.1	1052	12.2	959	12.7	980	13.4
4	1119	10.	1112	10.2	1093	11.	1093	11.6
5	1126	9.4	1119	10.2	1107	10.4	1049	10.5
6	1093	10.2	1058	10.8	959	11.	....	...

DISTRIBUTION OF PLACE WINNERS WITH REFERENCE TO MEDIAN S.I. OF ALL PERFORMERS IN DIVISION II—75-YARD DASH (SIX MEETS)
Median = 1053 (45 cases)

Place	*Above Median S.I.*	*Below Median S.I.*
First	5	1
Second	5	1
Third	3	3
Fourth	4	1

2. The times and distances for the various events are reported in Table V. It is interesting to note (*a*) how regularly records improve with each higher S.I. level and (*b*) the curious break away from regular improvement in performance for higher S.I. groups in Division 5. This break occurs throughout the Albany studies and will be the subject of a searching study during the next three years.

TABLE V
ANALYSIS OF EVENTS—SIX DIVISIONS
All-Team Meet, June 1, 1934
75-YARD DASH

Division	Number Contestants	Winner's Time	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
1	9	10.3	10.7	856	3	1
2	23	9.7	10.7	1058	4	0
3	26	9.4	10.2	1233	4	0
4	17	9.0	9.6	1462	2	2
5	15	9.1	10.0	1599	2	2
6	13	8.4	8.8	2054	3	1

BROAD JUMP

Division	Number Contestants	Winner's Distance	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
1	9	12′9″	10′8½″	856	2	2
2	14	13′2″	11′11″	1055	4	0
3	19	13′11½″	12′8″	1227	2	2
4	12	15′9″	13′5″	1470	3	1
5	17	16′	13′5½″	1608	3	1
6	9	16′11¼″	14′11½″	2054	2	2

HIGH JUMP

Division	Number Contestants	Winner's Height	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
1	4	3′9″	3′5½″	859	2	2
2	14	4′2″	3′7″	1050	5	1
3	19	4′10″	4′5″	1239	4	5
4	12	4′5″	4′2″	1490	3	2
5	9	4′3″	4′2″	1584	4	2
6	7	5′3¼″	4′10″	2199	3	1

8-POUND SHOT PUT

Division	Number Contestants	Winner's Put	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
4	7	32′5½″	27′11″	1462	2	2
5	9	31′5″	29′11″	1637	2	2
6	13	40′½″	31′7″	2004	3	1

100-YARD DASH

Division	Number Contestants	Winner's Time	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
3	7	12.5	12.7	1308	3	1
4	7	11.7	12.4	1485	2	2
5	12	11.8	12.4	1603	1	3
6	7	11.1	11.4	1969	2	2

220-YARD DASH

Division	Number Contestants	Winner's Time	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
5	7	27.7	28.3	1616	3	1
6	5	25.8	25.9	2055	2	1

880-YARD RUN

Division	Number Contestants	Winner's Time	Median Performance of all	Median S.I.	Place Winners above S.I. median	Place Winners below S.I. median
5	7	2.18.9	2.31.5	1612	2	2
6	9	2.17.7	2.26	2052	3	1

3. The possibility of a 200 point S.I. range securing equality of opportunity for participants on various levels is shown by Table VI which indicates the distribution of place winners with S.I.'s above and below the median for their Division in each event.

TABLE VI

DISTRIBUTION OF PLACE WINNERS IN EACH EVENT IN RELATION TO THE MEDIAN STRENGTH INDEX OF THE GROUP IN WHICH THEY COMPETED

Event	*Place Winners Above Median S.I.*	*Place Winners Below Median S.I.*
75-Yard Dash	79	55
100-Yard Dash	15	15
220-Yard Dash	11	6
880-Yard Run	21	14
Broad Jump	78	65
High Jump	59	48
8-Lb. Shot Put	23	20
Totals	286	223

4. The advisability of allowing junior high school boys to compete in the half-mile run was questioned. It was decided to restrict entries for this event and conduct a special study of all boys accepted. Only those boys (*a*) in S.I. Division 5 or 6, (*b*) at least fourteen years of age, and (*c*) with a good health record were accepted. These boys carried on a program of careful training and ran in the event as listed in the various meets.

Tests administered in March and again at the end of the season failed to disclose any significant changes. Further experiments concerning the use of the half-mile for junior high school boys are desirable and will be made.

SUMMARY

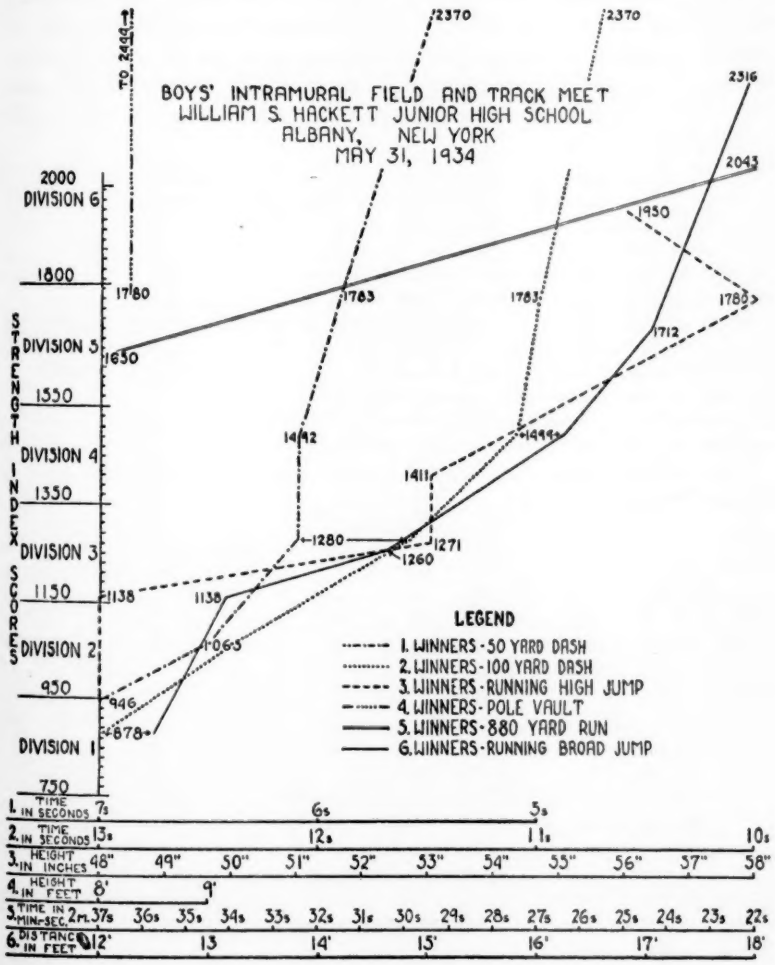
1. The program appealed to large numbers as is indicated by the attendance record.

2. The degree of interest increased as the season progressed. This is indicated by the continual increase in attendance.

3. The division of the boys into six groups and the redivision into four teams seemed to influence favorably the interest and attendance.

4. The propriety of the two-hundred-point range in each Division except the sixth is corroborated by the results indicated in Table VI.

5. The necessity for S.I. (or some other better) divisions and groupings is clearly indicated by the charts which show the progressive step-up in the results of all the events. These seem conclusively to prove that



directors of intramural sports ought not, in fairness to participants, or in hope of holding participants' interest, to call upon a group of individuals of high strength indices to compete with a group having much lower S.I. scores.

6. This grouping plan which utilized the Strength Index proved to be highly valid. The results obtained indicate that intramural track should be administered on the same plan in the future.

All of the foregoing data refer to the use of the plan in the Livingston Junior High School. The same plan was in operation at the William S. Hackett Junior High School as previously outlined, producing practically the same findings as noted for the Livingston School.

The following brief summary indicates some of the results in the Hackett Junior High School and is offered for the purpose of comparing the findings in the two schools. It is significant to point out that all testing, grouping, and classifying of pupils as well as the actual conduct of the meets was carried on by a different set of instructors. The fact that the findings agree so closely would seem to indicate a rather high validity for the plan.

SUMMARY OF INTRAMURAL TRACK AND FIELD ACTIVITIES
William S. Hackett Junior High School, 1934

Number of teams	4
Number of meets	8
Number participating in at least 1 meet	189
Number participating in at least 2 meets	171
Number of boys in school who were free to participate in after school program	522
Number participating in track	189
Percentage of boys participating in track	36%
Number of relay teams taking part in meets	68
Number of boys who took first place in at least 1 event	82
Number of boys who placed in at least 1 event	130

The following chart indicates the number of boys entered in each event in groups through the season.

	Divisions					
	1	2	3	4	5	6
50-yard dash	39	49	44	41	25	31
100-yard dash	44	35	34	33	26	33
High jump	37	40	27	27	25	24
Broad jump	45	57	47	40	31	47
½ mile					24	28
Shot put					22	43
Pole vault					8	21

Attendance at the meets:

No. 1	50	No. 5	58
No. 2	62	No. 6	63
No. 3	68	No. 7	181
No. 4	70	No. 8	47

ARMORY MEET

Number participating	140

BOYS' WEEK MEET

Number participating	150

Part IV

Omnibus

Mens sana in corpore sano

Is Physical Fitness Testing Adaptable to Y.M.C.A. Physical Education Programs?

By Robert E. Laveaga

NO ATTEMPT is made in this report to present a comprehensive research document. Such a report can only result after several years of experimentation.

Realizing, however, that the directorship in the Y.M.C.A. field is interested in learning of experimentations in testing, the writer presents the following material with a hope that it will motivate readers to search for and experiment with testing programs. The writer has observed several such programs in his own building during the past few months. This paper, therefore, reports each briefly, with comments on their apparent values and outcomes.

The following are reported:

I. Observations from three groups of college students: Northeastern University freshmen, Harvard dental freshmen, and Boston Optical College students.

II. Observations from tests given to members of the local Y.M.C.A.

III. Observations on techniques.

IV. Recommendations.

COLLEGE STUDENT TESTS

Northeastern University Freshmen.—Having the responsibility for the physical education program of the freshmen of Northeastern University, the writer recommended to Mr. Donald MacKenzie, a graduate student at Boston University, and also a member of the Northeastern faculty, that he write his thesis on the results of a series of tests with the entering freshman class at Northeastern University. The suggestion was accepted and the tests were given to 332 students in September, 1934.

The P.F.I. testing program was used, which so clearly gives a person a significant Index of Physical Fitness that it attracts the active interest of boys and men of all ages.

In the Northeastern University study, over three hundred freshmen were easily examined in three periods of about two hours each. This included a physical examination by a medical staff with assistants and about twenty men giving the tests. Two complete sets of testing apparatus were used.

Compared to previous experiences in examining the freshmen, it was noted that there seemed to be much more interest in the total examination than previously. The young men sensed that they were doing something which would in turn give them something tangible. The medical examiner's report of necessity leaves the layman with questions as to the exact meaning of "good," "fair," or "poor" for any particular part of the body. But when a young man is given a Physical Fitness Index of 65, he knows that he is far below par. (A P.F.I. below 80 is poor. When a person has a P.F.I. higher than 120, his physical education program should not be disturbed; when higher than 140, he should be cautioned, for he is getting "too fine.")

The men receiving P.F.I.'s below 80 were called back for special attention by medical examiners and special prescriptions of exercise were given them. (This same procedure was followed through with two other University groups, the Harvard dental freshmen and the Boston Optical College students. The retests on these two groups are about to be made.)

After testing was completed each freshman chose an activity, in which he participated twice weekly for six weeks, when he was retested. The freshmen at Northeastern are permitted to choose either the gymnasium program, football, cross-country, track, or wrestling for their physical education program. Men who cannot swim must report to the natatorium for this instruction.

The statistics summarizing the results of the first two tests are reported by MacKenzie.[1]

Several interesting observations should be made concerning this experiment.

1. The most significant is the surprising increase in fitness of men after the six-week program of activities, from the initial very high average P.F.I. of 106.2 in September to 111.6 in November. Undoubtedly this group of students would compare favorably with any other in the country. Their work at Northeastern, including study and all activities, apparently is of such a nature that the individual is able to maintain and improve his general health index. (The general rule is for college students to lose from 2 to 3 P.F.I. points each semester during the first year or two of college life.) One raises the question of just what will happen during the five years which follow when these students are left to pursue their own desires for physical exercise. The writer will endeavor to follow fifty of these young men through their college experience.

2. The increase in fitness of the low P.F.I.'s is worthy of attention. These men, eleven in number, increased nearly 10 per cent in less than two months between the tests. A study of each case would reveal that

[1] Pages 125–143.

the time given, and the work required for testing were worth while *for these cases alone*. Testing is of especial value to the individual whose index of physical fitness is low.

3. Football seems not to be very beneficial to those participating in it for this group was the only one to register a drop in the P.F.I. The leg strength of this group increased greatly but the arm strength dropped, while weight increased steadily; fat was put on, but was not converted into effective muscle tissue. However, as the second tests of this group were made three days after the final game, the players may have been "stale."

4. Students in the regular gymnasium classes with the so-called formal program, (so much under-rated) totaled a surprising increase going from 110.6 to 116.8. When one realizes that the average P.F.I. for college freshmen is between 90 and 95, the foregoing figures present a very gratifying report.

5. Track, with a beginning figure of 106.1 showed an increase to 113. However, the drop of .2 in lung capacity is difficult to explain especially with track men. (The lung capacity test is the only one which registered a loss for the entire group.)

6. Many students have been motivated to take an interest in their general health and to use these tests as a means of keeping account of their general condition. For the first time the department is ready to give a significant report on the progress of the members of the physical education program to the Association Secretary and Board.

Harvard Dental Freshmen.—Thirty-two students at the Harvard Dental School completed the tests in November. To date no retest has been given. The ranges of the items of the test may be of interest:

RANGES

Measures	Lowest	Highest	Mean
Age, years and months	19–2	25–4	22 yrs. 6 mo.
Weight, pounds	117	182	147.9
Height, inches	64.3	74	68.7
Arm strength, points	56	899	369
Leg lift, pounds	390	860	581
Back lift, pounds	320	590	461
Left grip, pounds	82	142	103
Right grip, pounds	80	158	117
Vital capacity, cu. in.	212	322	266
Strength index	1335	2669	1901
Norm	1557	2773	2013
P.F.I.	74	130	90

The arithmetical mean for the group was a P.F.I. of 90. The retests should show a substantial increase, as the students are participating in the present program with much enthusiasm.

Boston Optical College.—Fifty-six students reported for the tests early in October. The median P.F.I. of the group was 100, while the frequency distribution is as follows:

P.F.I. Frequency Distribution

P.F.I.	*Cases*
130 to 139	1
120 to 129	7
110 to 119	14
100 to 109	6
90 to 99	12
80 to 89	5
70 to 79	6
60 to 69	1
50 to 59	4

Retests have not been given to the above two groups which means that the value to date of their physical education program is as yet unknown. This is one of the strong points in favor of the measurement program. It stimulates instructors to perform to the best of their ability for they know that they, as well as students, are "checked-up" when retests are given.

OBSERVATIONS FROM TESTS GIVEN TO MEMBERS OF THE Y.M.C.A.

1. About one hundred tests have been given to senior members of the Y.M.C.A. and another hundred to boys. After experimenting for four months with the above men and boys there is no doubt at all of the value of this measurement procedure for the Y.M.C.A. The testing program will become increasingly valuable to the Association when it is incorporated and perfected as a regular part of the "Y" health program.

2. The chief value of testing seems to be that we can show by these tests whether a member is making progress or failing to do so. The results of the health examination do not, in most cases satisfy members; but when they have gone through the strength tests and have secured their indices, they have definite starting places from which to measure progress. Certain very interesting supervised work has been made possible by the tests: for example, a man with weak grip strength was given a series of exercises to build up the weak part. His active cooperation was secured, with the following results:

Date	*Right grip*	*Left grip*
10–23	105	108
11–1	106	115
11–15	110	117
11–20	114	120
11–27	114	130
12–4	122	128
12–16	125	135

3. By repeating the grip test at frequent intervals one is able to observe fairly accurately the progress or loss of general health. The complete test is given about every three or four months.

4. The testing program furnishes an opportunity for a quality program of real educational significance. Knowing exactly where a man's weakness is, the director is able to prescribe immediately the correct procedure rather than taking a chance with "gun-shot methods."

Tests are thus a valuable aid in helping to hold members. This value in itself is very great to Y.M.C.A. organizations, particularly in these days of increased recreational facilities.

TECHNIQUES

1. In the Young Men's Christian Association one is faced with the problem of insufficient help, which in some places, might render testing a burden. However, the answer to this difficulty is found in the keynote of the Association Movement, namely, "Service." Members and others respond eagerly to requests for help in the testing program. Often they are college students desiring experience in measurement procedure or school teachers interested in the field of measurement and physical education. Many other association members are test-minded and enjoy this type of volunteer service.

2. A second problem is that of financing the purchase of equipment. Many, in fact most, Associations have a spirometer, a set of parallel bars, and a set of flying rings. This leaves the hand dynamometer and the back and leg dynamometer to be purchased. The two can be bought for less than $150.00. When the value and the long life of these instruments are recalled it should not take a great deal of "selling the idea" to secure the apparatus.

3. Two convenient methods may be used for giving the tests: the first, which is similar to the battery-type tests given to the college students, when all report at certain times. Many examiners are pressed into service and are able to test a large number of men in any one evening. The second procedure is to have each member take the test immediately following his physical examination. If this is possible it is by far the most efficient method. The doctor or physical director making the health examination can conduct P.F.I. tests also, or can turn the member over to some regularly detailed tester.

4. If an Association has the club plan of organization, there is no better way to have the members of the club realize the significance of health than to have them brought to the gymnasium in a group and given the test. This will open plenty of doors for opportunity to talk with these boys and young men on questions of health.

RECOMMENDATIONS

1. That the Young Men's Christian Association study and experiment with this testing program as a way of enriching the work of the health education department, as offering a guide-post to members who are interested in health, and as a highly effective method of securing and holding members.

2. That no tests be given without previous medical examination of individuals and the approval of the physician.

3. That the tests be used to check a man against himself and not for the sake of comparing him with others. It is not competition we want but an individual and private analysis. If it becomes competitive then the value of the tests is materially reduced.

Evaluation of Certain Phases of a Junior College Physical Education Program

By V. F. Hernlund and N. G. Barfield

PURPOSES

THE PURPOSE of this study was to evaluate the program of physical education at the Emory Junior College and Academy at Oxford, Georgia, to determine: (1) the value of present practices and if necessary, point to needed changes; (2) student reactions to certain principles applied in the program; (3) future policies, in the light of discoveries; and (4) to provide an objective and authoritative basis for recommending programs to other schools seeking information.

CONDITIONS

Emory Junior College and Academy shares the conviction of the Mother Institution, Emory University, that physical education should be made available to all students and conducted in the most wholesome spirit. Physical education is regarded as a genuine branch of education. Emory Junior College and Academy attempts to provide every student with an adequate opportunity to develop educationally, physically, socially, and in growth of character, through active participation in individual and group athletic activities. With the students organized into three competing groups it is possible to carry on these activities in a way not unlike varsity athletics in other institutions, from the standpoint of seasons, training, and instruction.

So that all students might gain the benefits of sports, an intramural system was worked out for Emory University Academy immediately following the removal of Emory University from Oxford to Atlanta in 1920. Mr. E. J. Brown was directly responsible for the organization and plan of administration in practice when one of the authors first came in contact with the program in 1929. Much of the original idea remains, but in matters of emphasis and detail of promotion many radical changes have been made.

During 1931–32 the response to the program of athletic activities has obviously been better than at any previous time. This observation is supported by the greater percentage of entries in tournaments, by more faithful attendance at sport practice periods, and by a decreased number of students failing to earn credit in physical education.

At Emory Junior College and Academy the student body is divided into three units or "companies" for the purpose of individual and group

competition in athletic activities. These groups are designated as companies A, B, and C. The number of boys enrolled for 1931–32 was 143.

During the first two weeks of the school session the physical director checks over the lists of former students to determine the number enrolled who are already members of the three companies. In 1931–32 the new members were allowed to draw, on the basis of weight, for membership in a company. Drawings are made irrespective of physical or academic classification.

The sports and activities engaged in during the year may be grouped in the following manner:

Fall	*Winter*	*Spring*	*Year Round*
Football	Basketball	Baseball	Track and Field
Cross-Country	Volleyball	Track and Field	Tennis
Tennis	Speedball	Tennis	Handball
Handball	Wrestling	Speedball	Gymnastics
Diamondball	Boxing	Swimming	
Swimming	Tennis	Handball	
Gym Classes	Gym Classes	Gym Classes	
	Handball		

A SPECIAL INCENTIVE

Even though the wide variety of sports and activities listed above aids to a great extent in drawing out student interest, the director of physical education felt that an additional incentive might further insure the success of the new program. Accordingly, in 1930 a point system was devised to "reward" both individuals and groups. The awarding of points seemed to provide that needed further incentive for a certain class of students who require a little coaxing to engage voluntarily in the physical education program.

The statements listed below serve to present in a concise form the essential features of the scoring system.

1. Points are awarded for the practice of a sport. A practice period must be "for at least sixty minutes" to earn points.
2. Points are awarded to individuals on both winning and losing teams engaged in a contest.
3. Points are not awarded to a team or group except as they are earned by individuals.
4. Points may be received in not more than two sports in any one day.
5. Points are earned by meeting the required classes in physical education.
6. Students are honor-bound to report honestly the points earned.
7. The Company Cup is awarded each year to the company which has totaled the highest number of points.
8. The individual student earning the greatest number of points during the year is awarded a medal designating him as such.
9. The five students having the next highest scores are awarded regulation school monograms.
10. Student company secretaries keep records of the participation of company's members.
11. Permanent individual scores are kept on file in the office of the Director of Physical Education.

12. Company standings are represented graphically each week.

13. Monograms are awarded in football, basketball, baseball, track, tennis, and gymnastics upon compliance with the requirements for earning a letter in that sport.

To reduce the recording work to a minimum, individual daily scores are reported on weekly score cards. A permanent individual record card has been devised to which the student's weekly score is transferred. The recording is simple and student assistants can easily attend to this task each week.

AN EXCLUSIVELY INTRAMURAL PROGRAM OF COMPETITION

Every student receives instruction in the different activities he elects and sufficient opportunities to practice and play with his team. Organization of teams with this point in view is so managed that "winning" in actual contests is not regarded as the sole aim. Coaches encourage team members to put forth their best efforts, but they also take advantage of opportunities which arise in contests to call attention to points of fair and foul play and sportsmanship.

The type of physical education program under consideration in this study makes it altogether unnecessary to have competition with other schools. There may be some disadvantages of a sports program confined to the home campus; but from past experience in observing the functioning of the whole program toward the objectives held for it, these disadvantages seem to be far outweighed by its desirable features.

The advantages and disadvantages of this program are not the subject of this paper. It deals exclusively with the problems of classification and incentives. We wished particularly to investigate (*a*) our method of selecting students for companies, (*b*) our guidance of individuals in their activities, and (*c*) the propriety of our special system of incentives.

INQUIRIES

1. *What physical differences existed between the three companies?* An answer was sought using the P.F.I. as the physical measure which most significantly measures physical powers. One hundred students were tested with the following results:

TABLE I

P.F.I. Interval	*P.F.I. Distribution Cases*
115 to ...	12
100 to 114	39
85 to 99	40
... to 84	9

The distribution of P.F.I.'s by companies shows how variable were students in each company in terms of physical powers to engage and persevere in activities.

Table II reveals two significant facts. First, the companies varied

considerably in physical powers, company A being 7 per cent better off *on the average* than its opponents in both S.I. and P.F.I.

Second, the company winning the largest number of points was not the one most favored physically. Evidently some other factor contrib-

TABLE II

AVERAGE AND TOTAL SCORES BY COMPANIES

Company	Average S.I.	Average P.F.I.	Total Company Score in Activities
A	1817	104	5505
B	1650	97	6209
C	1672	98	4301

uted to its total activity. This fact is further established by the data reported in Table III.

TABLE III

PHYSICAL FITNESS INDEX DISTRIBUTION COMPARED FOR COMPANIES A, B, C

	A		B		C	
Distribution	f	%	f	%	f	%
115 – up	7	21.9	1	2.9	4	11.7
100 – 114	13	40.6	15	44.4	11	32.2
85 – 99	12	37.5	13	38.1	15	44.4
84 – down	..	...	5	14.6	4	11.7
Total	32	100.0	34	100.0	34	100.0
Mean P.F.I.	104.2		97		98.3	

Now, it is desirable to have the companies begin the year with practically the same average S.I. and P.F.I., for equality between opponents is a first condition of fair play.[1] As the season progresses and improvement is made the groups will necessarily vary from the totals with which they started; but by consideration of the activity up to that point, equalization may be maintained by the proper assignment of incoming students late in the year.

But it has been revealed here that the system of selecting students for the various companies does not equate opponents, and therefore ought to be modified to guarantee at least an equalization of physical powers between competitors.

2. *Is there any relation between physical powers as measured by P.F.I. and the response of students to the activity program?*

We noted above that the strongest company did not win the cup. But perhaps some unique plan of attack accounted for the victory,

[1] To say nothing of its importance in insuring interest in, and the success of, any intramural activity program. See Part III of this Supplement. (Ed.)

rather than superior physical power, which B company obviously lacked.

This problem was attacked, first, by segregating the scores of the ten students who were average, lowest, and highest in activity scores and determining their average P.F.I.'s.

The results are summarized in Table IV.

TABLE IV
AVERAGE SCORES OF VARIOUS GROUPS

Group	Average Activity Score	Average S.I.	Average P.F.I.
Highest 10	473	1868	107
Middle 10	168	1828	103
Lowest 10	36	1440	87

The authors consider this evidence of correlation between activity scores and P.F.I.'s to be very significant. Evidently the relation between P.F.I. and activity is positive and high in spite of the fact that a company with less than the highest average won the cup.

3. *Then why did B company win the largest number of activity points?*

The authors are confident that internal organization and leadership were the deciding factors. B company is organized within itself into eight small groups. These groups competed with each other in earning points from week to week throughout the year. Because of this incentive they were more careful to report every point earned than were the members of A and C companies who had no such inner organization. The authors are convinced that this explanation is adequate to account for the variation from the established principle. If A company had been organized within as B was, we are of the opinion that the total score of A company would have far exceeded that which was actually totaled —and might easily have exceeded B company's score, *for A company had the superior physical power.*

4. *Is there need of redirecting the activities of individuals?*

The evidence so far adduced points strongly towards the necessity of treating individuals in each company more *as individuals* and less as equal members of a team. This is particularly brought out by the small number of activities for the low P.F.I.'s. These boys above all need individual attention and a fairly large number of physical activities to develop them into normal young men with at least a fair amount of enthusiasm for activity. But they lack endurance—surplus physical power—and so they tend to become less and less active. These sedentary habits are likely to persist unless altered while boys are still in school.

Contrarily, those with high P.F.I.'s do not need to engage in so

many physical activities. The program itself, as well as the guidance of supervisors, should lead these to engage in other forms of living than violently physical ones.

Thus, the strength tests show very definitely that those students who participate most as a whole have the highest Physical Fitness Indices; and vice versa, those that participate least have the lowest Physical Fitness Indices. This may be due to the individual's high P.F.I. gained before enrollment or it may be due to participation after enrollment. The evidence of an imposing array of experiments elsewhere makes it necessary to accept the viewpoint which regards the P.F.I. as the indication of the individual's organic vigor and fitness for meeting life's tasks. *Then during the course of the athletic program those students with low Physical Fitness Indices and low individual activity scores should be the object of the most attention by coaches and supervisors so as to improve their physical fitness and therefore their "chances in life" physically.*

5. *Is the special incentive program worthy of continuance?*

As a method of stimulating more activity, the point system of competition induced more activity than had occurred before it had been introduced. But even the most cursory analysis of P.F.I.'s reveals that students were not stimulated in accordance with their needs. *The condition was quite the reverse.* Moreover, there was no adjustment of activities to individual needs on any level or in any company.

The scoring system did seem to stimulate company B to plan and execute a superior method of action—that of dividing into smaller competing groups within the company, which stimulated each other to "more activity." But more activity of the wrong kind is only worse than none at all. Thus, it is questionable whether the point system, *in the long run,* is a safe device, since competition itself is a destructive social technique, while certainly the tendency is to disregard students' real needs. An investigation should be made to determine all the effects of the point system—or at least the chief physical and social effects.

CONCLUSIONS

In interpreting the results of the evaluation of the program of physical education activities at the Emory Junior College and Academy, the following facts should be considered:

1. The scoring system for participation in activities was already in operation and functioning with a reasonably fair degree of success so far as student interest and participation in activities were concerned. However, this system seems to stimulate the most efficient, who need activity least, to participate most, while it fails to stimulate many who need activity most to indulge in more than a bare minimum of activities and is anti-social in consequence.

2. The P.F.I. tests were introduced to discover if better means of

equalizing company teams were available and to see what relation the point system in participation had to the strength tests. It was discovered that the weight basis, while not a bad means of equalizing opponents, yet was far from satisfactory[2]; and it was concluded that the P.F.I. or S.I. basis of selecting companies is considerably better. Research should be begun immediately to determine whether the S.I. or P.F.I. is more productive.

3. The results presented indicate that participation in a number of activities goes along with a higher strength score and a higher physical fitness score. Since in this group those individuals with low participation had also low strength and physical fitness scores, the conclusion seems justified that the application of the strength test measures will provide a means of singling out those individuals who need special attention and possibly special motivation in activities, if the program of physical education is to lend itself to a better functioning of the entire organism.

4. Carefully maintained records of the scoring system in participation and the strength measure over a period of years should enable one to determine even more accurately the effect of program, participation and motivation upon those individuals who at the present time are below the average of their company members both in participation and in strength.

[2] The S.I. is just twice as valid as weight as a measure of competitive ability in actual contests. Probably the P.F.I. is even better when the Emory system is used. (Ed.)

Uses of the Physical Fitness Test Battery in the Personnel Department of an Industrial Plant

By Harry G. Oestreich

IT IS generally recognized that health is an invaluable asset for success in life, be the occupation what it may, but the degree to which this quality contributes to the sum of man's temporal achievement has never been demonstrated. It is unquestionably vital to the physical well-being of our society that we be able accurately to measure the emphasis which health deserves as an assurance for success. Such a measuring device would be of enormous economic worth to industry, and herein lies a future development of dynamic tests and measures of physical fitness. The field is new and uncharted, but the opportunity for a definite contribution exists.

The P.F.I. has proved its worth as an educational device which measures an individual's health—"capacity for activity." Innumerable experiments have been conducted which reveal its diverse utility; and the fund of evidence that substantiates the contentions advanced is voluminous.

The following is a sketch of a proposed study by the author which is to be presented as partial fulfillment for a Doctor's degree in Education:

Purpose.—It is the purpose of this study to determine the prognostic value of the Physical Fitness Test scores to ascertain employees' aptitudes for continued efficient service in the type of work for which they are employed.

Scope.—These tests are to be given to a fair sampling of the employees of (Hood Rubber Co.) selected at random, but guided to the extent that all phases of work in the industry be adequately represented. Retests will be made at regular intervals to determine changes in physical status as revealed by the original and subsequent tests.

The data obtained from the above testing procedure are to be manipulated to determine:

1. The relation between P.F.I. and accidents at work.
2. The relation between S.I. and accidents at work.
3. The relation between P.F.I. and illness leaves from work.
4. The relation between S.I. and illness leaves from work.
5. The relation between P.F.I. and tenure of work.
6. The relation between S.I. and tenure of work.
7. The relation between P.F.I. and work efficiency.
8. The relation between S.I. and work efficiency.

9. The relations between combinations of P.F.I. and S.I. and accidents, illness leaves, tenure of work, and work efficiency, to determine the best composite.
10. The relation between speed of work, hours of work, and type of work to the physical status of the laborer.

The breadth and depth of this study will of necessity depend on several factors. For example, the size and treatment of the sampling will be influenced by the following considerations:

1. The amount of equipment.
2. The intervals between retests.
3. The number comprising the testing staff.
4. The amount of time allotted to testing.
5. The ease by which subjects can be obtained for testing.

To check the validity of the P. F. I. as a measure of "capacity for activity," three criteria have been set up for the measurement of work efficiency:

1. The work superintendent's rating.
2. Piece-work rating.
3. Promotion and pay raise rating.

Ultimate Aims.—The aims of this study are to:

1. Determine the prognastic value of the test scores relative to the prospective employee's aptitude to fill a vacancy for which he has applied.

2. Arrive at P. F. I. or S.I. standards which will numerically describe an employee's capacity for continued service at specific types of labor.

3. Offer evidence toward the solution of best age or time when the Old Age Retirement should begin by investigating the propriety of determining retirement in terms of S.I., P.F.I., or some combination of the two qualities.

4. To establish, if possible, standards on the basis of the S.I., P.F.I., or some combination of the two, which will aid in the organization of working hours, job schedules, etc., without injuring the health and impairing the working efficiency of the employee.

Case Studies of Unusual Physical Fitness Indices

By Elizabeth Zimmerli

THE VALIDITY of strength tests as measures of capacity for physical activity needs no further demonstration than the logician's argument: without strength there can be no physical activity; capacity for activity must be proportional to strength; the two are as "inseparable" as the two sides of a coin. But the inner significance of Physical Fitness Indices is often obscured by the variety of conditions they may accompany or reflect—like blood temperatures or tuberculosis or I.Q.'s.

Many casual critics have observed that P.F.I.'s are poor substitutes for medical examinations. The writer understands that they were never so intended. But that they may be valuable—sometimes invaluable!—*supplements* to medical examinations, no one who has compared P.F.I. records with mental or physical health reports can doubt.

It was to provide herself and others with material which might deepen their insight into the meanings of P.F.I.'s that the writer gathered some hundred-odd reports of "unusual cases" from physical educators whose experience in testing and analyzing pupils was fairly extensive. Unusual cases were desired because these bring into sharper relief conditions which must exist at every P.F.I. level.

The reader should not fall into the error of concluding that he or she can, from P.F.I.'s diagnose causes of deficiencies. The fact is quite otherwise. A low or high Index is merely a *danger sign*—an added danger sign in cases where other stigmata are present, such as marked over- or underweight, appearances of fatigue in complexion or posture, abnormal temperature, etc.—*but often a unique danger sign when the subjective analyses of general practitioners fail.*

MISCALCULATIONS AND MISINTERPRETATIONS

This report will take occasion, also, to correct other apparently common misinterpretations and misuses of P.F.I.'s. For example, occasionally a reporter's confidence has wavered concerning the significance of P.F.I.'s which hover near average—or even those which seem to indicate conditions contrary to *subjectively determined* "facts." The cause is not seldom to be found in simple errors in arithmetic, as for example, that reported to the writer from a large mid-western city. The reporter expressed concern because a girl's P.F.I. had risen sharply without ap-

parent reason and contrary to subjective judgment of the child's true status:

1. H.K. (Rocky Mountain State), whose P.F.I.'s were 82, 79, 106, 90, 125. The reporter says "very poor in physical education work; she failed work for two semesters. No athletics with no interest in activities." A check of this card revealed two errors, one in choice of norm and the other in adding push-ups and pull-ups—6 plus 16 were made to total 32. When this test was recalculated the P.F.I. was found to be 108, confirming the teacher's judgment of the pupil's condition, but correcting her misjudgment of test significance.

A second common error noted by the writer is reflected in the bewilderment of many correspondents to account for high P.F.I.'s in pupils inexperienced or uninterested or unskilled in sports. This misinterpretation probably comes about because of the known fairly high relation of S.I.'s and P.F.I.'s to athletic abilities. Those who use strength tests to classify pupils in sports or to equalize opposing teams should remember that these Indices are far from being perfect measures of ability in any *particular* sport. They indicate limits of accomplishment, as an aeroplane motor's horsepower limits its speed but not its actual manœuverability, except in a general way. Thus:

2. R.S. (New York) whose P.F.I. was 120 was criticized by the reporter as "poor in her apparatus gymnastics work and uninterested and unskilled in most sports. She dances well, but can hardly throw a ball. Why is her P.F.I. so high?" asks the reporter.

And the reverse is often true with boys:

3. E.P. (New England) whose P.F.I. is 88 is "an outstanding star in three major sports. Why should his P.F.I. be low? He is as hard as iron." But this boy weighs 182 pounds. His athletic prowess is due to high total strength, rather than "fitness to keep going at a rapid pace for protracted periods."

DISAGREEMENTS BETWEEN MEDICAL JUDGMENTS AND P.F.I.'S

The writer is particularly intrigued by the cases in which examining physicians have failed to discover defects or diseases which low P.F.I.'s forced them later to seek and find. For example, from a large eastern city:

4. R. (New York) whose P.F.I. was low. Test apparently inaccurate because pupil did not lift properly. No defects on medical examination or personal history. The low P.F.I. brought the pupil to the director's attention for a personal interview which disclosed the fact that the pupil "felt strained" whenever he lifted.

The pupil was referred to a physician for a thorough re-examination. Diagnosis: enlarged inguinal rings. Operation recommended. Contacts made with hospital, physician, and family. Operation performed during Christmas vacation. Pupil back at school, well on the way to normal, active life.

5. G. (New York) whose P.F.I. was low on account of poor leg lift. No defects reported on medical examination. Complained of pains in arch and calf. Pedograph prints showed right arch angle of 27 degrees, and left arch angle of 36 degrees.

Given "home work" card of exercises to be practiced daily. In six weeks, increased right arch angle 11 degrees, and left angle 1½ degrees; no pains in calf or arches. Went out for track team, and ran 440 in 52.3 seconds.

6. G.F. (Lynbrook) was observed by the school physician to have an apparently weak right grip and low vitality. The physician could find no cause, but appealed to the director of physical education. Reference to the pupil's record card showed P.F.I.'s as follows, over a period of three years: 109, 98, 99, 84. His general fitness was, therefore, declining. His lung capacity was 112, 120, 150, and then 140, indicating some fundamental defect. His left grip was 50, 55, 70, 82, indicating a normal increase in the power of this hand, but his right grip was 50, 60, 70, 65, indicating some defect on the right side. The record also showed a low right shoulder and slight scoliosis in the vertebrae.

Still no first cause was apparent. The boy was sent to an orthopedic physician who diagnosed it as syringomyelia. A year later the boy had almost completely lost the use of his right arm.

7. R.F. (Montreal, Canada) P.F.I. 58. This first P.F.I. was scored in December with no report of defects by the physician. Special attention was given him and in June his P.F.I. had risen to 71. But in September he had slipped back to 61. The physical director became suspicious, advised the boy to secure a thorough physical examination. This was done.

The physician's report of various laboratory analyses and tests closed thus: "I think there is no question that the problem is chiefly one of focal infection plus a slight endocrine imbalance. I believe the sooner he has the sinus infection cleaned up the better it will be."

The case recorded above is one of those clear cases in which the P.F.I. revealed conditions which the ordinary medical examination does not discover. Such cases, however, are relatively few and perhaps ought not to be emphasized or pointedly brought to the attention of physicians for fear of misinterpretations.[1] Of course it sometimes happens that the P.F.I. fails to reveal defects which are apparent to medical examiners. But no measure is or can ever be perfect.

CONDITIONS REFLECTED IN LOW P.F.I.'S

What may be done for pupils with low P.F.I.'s is indicated by the following dozen examples. They have been chosen to represent a wide variety of conditions which are reflected by low P.F.I.'s.

8. J. (New York). Low P.F.I., *underweight, poor posture*. History of "spotty" paralysis, resulting in partial atrophy of left arm and shoulder. Referred to orthopedic physician, who prescribed developmental exercises for atrophied condition, posture training, and diet instruction.

In five months, pupil has raised shoulder height ⅛ inch; gained 7 pounds; improved his posture; and increased his P.F.I. 30 per cent.

9. Z. (New York). Low P.F.I.—*poor arm and shoulder score on account of stiff elbow joint*. Referred to orthopedic physician, who prescribed special exercises with pulley weights. Pupil can now, at end of second semester, straighten fully the elbow joint, and shows a high degree of flexibility; with a P.F.I. increase of 20 per cent.

10. K. (New York). Low P.F.I.—*markedly obese*; flat feet. Medical examination showed no glandular defect. Physician prescribed regulated diet, daily "work-

[1] It is highly significant that practically every physical educator who introduces P.F.I. testing into school or camp work reports that his medical examiners have subsequently become very much more proficient in examinations and interested in follow-up work. (Ed.)

out," and foot posture exercises. In one semester pupil has lost 7½ lbs., improved P.F.I. 10 per cent and shows progress toward correcting faulty foot posture.

11. F.S. (New England) P.F.I. 84—*average weight for height and age.* No physical defects reported before, during, or after the medical examinations. However, when parents were told of the low rating, the father called at the school to discover the reason, and revealed the true cause.

During the preceding year, the boy had had five mastoid operations and ptomaine poisoning. In convalescence the boy gained sufficient weight and color to mask his true weakened condition from physicians.

As a consequence of the P.F.I. test report the parents, boy, family physician, school physician, principal, and physical director will cooperate in protecting his health.

12. B.I. (New England Private Camp) P.F.I. 61. This girl, about "five pounds underweight for age and height" is a *psychiatric case.* She "sprains" her back whenever she lifts, complains to parents on the slightest provocation, is boss of the family at twelve years. She comes of a very well-to-do but eccentric family.

The P.F.I. test revealed an apparently weakened body, but the score was "circled" because no leg lift or arm strength tests were given. This girl was referred to a psychiatrist and her parents warned of her growing mental maladjustment.

13. R.S. (New England Camp) P.F.I. 70. Slightly overweight but handsome. His defect is *social maladjustment.* He watches others, is self-conscious, is a fingernail-biter. He is jeered by his playmates and avoids self-testing. He is the butt of the camp and admits social and even physical defeat. The treatment indicated is involved but straightforward.

By requiring R.S. to engage in daily exercises and curtailing his diet somewhat he can be very greatly improved in actual physical powers within a month. When shown his improvement, and as he sees himself surpassing his tormentors, he will gain new confidence. (Unfortunately the report does not state how this case was handled.)

14. W.G. (New York State) September P.F.I. 67—weight average for height and age. *Eyes badly strained by school work.* The only defect of this boy was eyestrain and the consequent fatigue of study. Glasses were provided, study became easier and the following May his P.F.I. had jumped to 108 in spite of a weight increase of 10 pounds and an increase in height of two inches.

15. M.A. (New York State) September P.F.I. 65—weight average for height. *Some evidence of malnutrition due to faulty diet, and goitre.* A physician's care was secured and proper food provided for this girl. In May her P.F.I. was 95.

16. P.C. (New York State) P.F.I. 76—weight average for height. *General fatigue due to overambition.* This boy appeared big and stalwart. He participated regularly in cross-country, was faithful, trained well—too well, but year after year "came in last." The reporter "was at a loss to understand his failures as seemingly everything was in his favor." The first strength test revealed the reason: general muscular weakness. He was induced to drop cross-country and a year later his P.F.I. was 95.

17. B.L. (Minnesota) P.F.I. 63—weight-height relationship excellent. *Emotional imbalance* was the cause of this girl's low P.F.I. She was nervous, easily upset, lacking in accurate neuromuscular responses. Inquiry at home revealed a head injury at birth, the girl now being under the care of the Mayo Clinic.

As a growing child she could not coordinate sufficiently to walk. Careful individual attention will work wonders with this girl of sixteen years. Within a month her grip strength alone was raised 20 per cent.

18. F.M. (New England) P.F.I. 79. *A kidney injury* during football was the cause. This case is of special interest because the boy had been an outstanding athlete in three major sports for three years. His score was so surprisingly low that the physical director retested him soon after, with the same result. The boy then told

the puzzled instructor the reason *which he had hidden up to that time from everyone*, though last spring his previous outstanding superiority as a baseball pitcher completely deserted him. . . .

19. N.E. (Northeastern University) P.F.I. 61. This boy was *obese*, weighing 224 pounds. A special program was given him which he failed to follow. Six weeks later, a P.F.I. test showed a gain in weight to 235 pounds and P.F.I. 57. At this time the director accepted N.E. as a special challenge. (These are the most difficult cases.) At the end of the second six weeks his weight was reduced three pounds and his P.F.I. raised to 67—a remarkable gain, for his strength had increased 10 per cent.

CONDITIONS REFLECTED IN HIGH P.F.I.'S

If low P.F.I.'s are interesting and revealing, it is no more than the layman would suppose. But quite as interesting reports result when we probe very high P.F.I.'s. The theory is that these individuals are overdeveloped—too "fine"—about to "go stale" or even suffer physical and nervous breakdowns. Even at best, they are maintaining physical powers they do not need and are likely to become muscle-bound. One of these is:

20. R.K. (New England.) His record is so extraordinary that it is reproduced in full below:

Grade	II		III		III	
Age	15y	8m	16y	1m	16y	3m
Weight	161¼	—	161	—	161¾	—
Height	70	—	71	—	71	—
$\left(\frac{\text{Wt.}}{10}+\text{Ht.}-60\right)$ *Multiplier*	—	26	—	27	—	27
Pullups	34	—	27	—	30	—
Pushups	29½	64	31	58	40	70
Arm Strength	1	04	2	16		
	15	60	13	50	18	90
Lift-Legs	9	35	10	00	10	80
Lift-Back	4	35	7	45	7	00
Grip-Left		97*	1	32	1	40
Grip-Right	1	37	1	35	1	40
Lung capacity	3	10	3	40	3	38
STRENGTH INDEX	3578		3918		4288	
Normal S.I.	2059		2116		2116	
PHYSICAL FITNESS INDEX	173		185		202	
Classification	*Broke Arm					

This boy is seriously overdeveloped. He was stimulated, the director fears, to train up by an outstanding first record. A generation ago strength tests received a black eye because so many college men engaged in absurd weight-lifting and other exercises "to break the Harvard strength test record." R.K. is now badly muscle-bound, though apparently not yet overstrained.

This record is highly significant also because it proves that P.F.I. norms are not "too high for boys above average size" as is often imagined by directors who so judge norms when "star athletes" turn up with low P.F.I.'s.

Each of the following cases indicates a different condition:

21. M.K. (Minnesota) P.F.I. 156 though apparently much underweight (height 65.8, weight 102). *General appearance poor; physicians disagree on condition.* M.K. owns a horse, rides every day, general appearance deceptive; roundshouldered, thinness accentuated by heavy bones. Frequent dark circles under eyes. Restless and overvivacious. Health service record reads: "Medical re-check before permitting vigorous activity." But the family physician approved her for any activity. The high P.F.I. with other signs, indicates definitely that M.K. is overtrained.

22. G.K. (New England) P.F.I. 150. *No other conditions noted,* until parent visited school when told her son was "too strong." She reported boy's father "overdid" and was high-strung, so that he had suffered a "nervous breakdown." The boy's tendency was to be "like father"—play tennis hard all day and so forth. Parents advised to have boy curtail physical activity.

23. P.R. (Boston) P.F.I. 198. She was reputed the "strongest girl in the neighborhood"—best runner, skater, and so forth. She had no apparent physical deficiencies, but investigation revealed *social and scholastic maladjustment* with an I.Q. of 110. She has repeated the seventh grade twice, for she cannot sit still long enough to concentrate. Her home environment is difficult. Wealthy family, but one of eleven children, whose father is said to have "died of the shock of losing his last million." P.R. is a charming girl physically and emotionally. She needs only to be restricted in physical activity and induced to study or read.

24. A.E. (Boston University) P.F.I. 145. *A clear case of physical fatigue.* Miss E. complained that for three years she had been tired. Her weight had dropped from 145 to 121 (height 66 inches) without apparent reason. Overtrained, overstimulated, overanxious; a candidate for a psychiatrist unless she changes her program.

25. B.H. (New England) P.F.I. 189—*overambition.* This junior high school girl is apparently normal—very attractive in appearance, apparently quiet. This report is made in detail to indicate a helpful form.

a) *Physical Status.*—High P.F.I. due to three or four factors. She rides a bicycle constantly in a hilly community; has taken private dancing lessons for five years; swims all summer; and comes from a family well-to-do and socially active.

b) *Social Status.*—An active leader of social groups. She is a ringleader of an "overactive" social group (teacher judgment). The mother is a Y.W.C.A. lay leader who stimulates the girl. The girl is a behavior problem in school and was disciplined last spring for emotional outburst at examination time. The teachers say she can accomplish "anything she *wants* to do." She has strong superiority complex which is covered up by show of modesty and refusal to extend herself unless or until she is certain to perform very well.

c) *Academic Status.*—"Fair to middling." Has I.Q. of 112; refuses to extend herself academically; has grades of *B* to *C*, dropping from high *B* to middle *C*.

d) *Treatment Recommended.*—A complete review of her physical and social activity programs in school and out—to "steady her down." She needs much less physical activity, more reading, less social excitement if she is to avoid excessive physical and emotional strain.

The Relationship of Certain Sociological Factors to P.F.I. Tests in a Specific Rural Environment*

By Harold K. Jack

PURPOSES AND METHODS

IT IS the purpose of this study to discover what influence certain sociological factors may have upon P.F.I. test scores. Individual differences in physical capacity and indications of defects as measured by this test cannot be dealt with or defects corrected from an analysis of the test score alone. *The sociological background of the pupil must be included.* Due, perhaps, to the lack of appreciation of the importance of sociological factors, teachers often ignore the influences that these factors may have upon test scores.

1. It is the purpose of this study to investigate to what extent certain sociological factors may influence test scores.

2. The sociological factors to be compared with the P.F.I. tests are as follows:

a) Hereditary factors, as judged from a comparison of P.F.I.'s of siblings.
b) Intelligence, as measured by the Otis Self-Administering Test.
c) Economic status of the family, as obtained from a joint rating of the Sims socio-economic chart and the ratings of school officials.
d) School attendance, as obtained from the school records.
e) School success, as measured by the average grade of the pupil in his regular work.
f) The size of muscle, as obtained by using the method devised by Franzen for the measurement of muscle.
g) The amount of subcutaneous tissue, as obtained from the method recommended by Franzen.
h) Tuberculin history, as obtained from the various school records.
i) Racial factors, as judged by a comparison of whites and Indians.

3. P.F.I. and other tests were given to 246 pupils in grades 5-8 inclusive in the 20 rural schools of District No. 6, Itasca County, in November 1933, including 120 girls and 126 boys. Inasmuch as every child in the 4 grades mentioned was tested, the data are representative of the situation as it exists in that particular locality. Thirty-nine of the children tested were of Indian blood. The remaining children were of pure white stock.

The P.F.I. test was given in one session, when readings for subcutaneous tissue and size of muscle were also obtained.

The economic status of each family was determined by the Sims

* Abstract of a Master's Thesis prepared at New York University in 1933.

questionnaire combined with the ratings obtained from the Rural Supervisor and the Superintendent of Schools.

School attendance was obtained from the records of classroom teachers. The attendance period used was the first semester of the school year, 1933-1934.

School success for each pupil was measured by the average mark earned during the first semester of the school year 1933 to 1934. Although it is known that school marks are not a reliable measure of what the child has learned in school or has obtained from school, yet they were the only means available to obtain a measure of school success.[1]

The amounts of subcutaneous tissue and the measurements of size of muscle were obtained by the method used and recommended by Franzen.[2]

Tuberculin histories were obtained from the records in the office of the school and from the records of the Minnesota State Tuberculosis Sanitarium. Mantoux tests and X-rays were the devices used to check for tuberculosis.

The race of each individual was obtained from the school records and checked at the time of testing. The two races were white and Indian.

The objectivity as well as reliability of the P.F.I. test results was checked by having a group of boys tested on different days. The first day the regular tester gave them the test. On the second day a second trained tester gave the test.

The correlation obtained between the two testings was .89. Such a correlation is indicative of a high enough relationship to establish a reasonable reliability of test results as well as the objectivity of tests and efficiency of testers.

The same procedure was followed in checking accuracy of technique in the testing of the amount of subcutaneous tissue and size of muscle. The correlation between the two testings for the size of muscle was .96. The correlation obtained for the 2 testings of subcutaneous tissue was .83. In both cases the correlation was high enough to show that the testing was efficiently performed.

COMPARISONS OF FACTORS

Genetic Factors.—In considering the genetic factors the following correlations were made: comparisons of the P.F.I.'s of siblings. The correlation between 72 cases of P.F.I.'s of siblings was .16. This relationship was lower than that reported from a previous investigation of Kulp and Davidson who obtained about .40 on strength and such physical factors as height, weight, and a physician's judgment. Inasmuch as

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[1] See also the comments of Giauque, page 272.

[2] *Physical Measures of Growth and Nutrition*, Chapter II.

the P.F.I. is a more valid measuring device for determining true physical fitness than such static or unreliable measurements as weight and subjective medical judgments, it would seem from the above data that there is less similarity between siblings' physical powers than has been previously reported. The new results may be due to the present more concrete and objective measuring devices of physical fitness.

Relation of Intelligence to Physical Fitness.—The results of all comparisons between intelligence and physical traits have resulted in correlations of approximately zero.[3] In most previous cases a doctor's evaluation of physical condition was used as the basis. Using the P.F.I. as the measure of physical power and correlating it with the I.Q. as obtained by the Otis Self-Administering Test a correlation of .0006 for boys and .02 for girls was shown. These results agree with findings by other investigators. Apparently the physical condition of the child has little effect upon the I.Q., or vice versa.

Comparison of Economic Status with Physical Fitness.—The Sims socio-economic questionnaire was used to determine objectivity in the measurement of economic status. However, to check the validity of this test for this study, various school officials, including the superintendent and rural supervisor, rated the families. The correlation coefficient for the combined ratings with the P.F.I. was .34 for the boys and .08 for the girls. From these correlations the Predictive Indices of which are .06 and .00 respectively, it can be seen that the homes in this part of Minnesota have some slight influence upon the P.F.I. The home background is usually an important factor in the development of the child. The correlation obtained above indicates that some relationship exists and that the home must not be ignored. On the other hand, the correlation is surprisingly low.

Comparison of School Attendance with Physical Fitness.—Attendance at school is often considered to depend on health. We assume that the child in good physical condition will be anxious or able to attend school and participate in its activities. Are the students who stay out of school those individuals with low P.F.I.'s and therefore low in health and vitality? Or is school attendance another matter?

The correlation coefficient between the P.F.I. and attendance records is —.02 for the boys and —.21 for the girls. The conclusion would follow that little or no relationship is shown. Apparently many factors enter into the attendance problem beside general physical fitness. Factors such as transportation, work at home, and the lack of interest in school account, in part, for the low correlation obtained above.

However, in addition to the above correlations the mean P.F.I. was

[3] See particularly the bibliography of Rogers' *Physical Capacity Tests in the Administration of Physical Education*, Chapter VII. New York: Bureau of Publications, Teachers College, Columbia University, 1925.

calculated for the boys and girls who were not absent a single day in the time covered by this study, and this mean was compared with the mean P.F.I. of those who were absent one day or more. The mean P.F.I. of boys not absent was 98.8, while the mean for those absent one day or more was 83.3—a difference of 15.5 P.F.I. points, or 17 per cent. The mean P.F.I. of girls with no absence was 98.2 and of those absent one day or more was 93—a difference of 5.2 points or 6 per cent. These differences between means, especially for the boys, may be indicative of the effect on school attendance of their health and vitality. Further "the significance of the difference of the means" was calculated, and shows that the chances are 90.6 out of 100 for the girls and 99 out of 100 for the boys that the average P.F.I.'s of cases with perfect attendance record are higher than the P.F.I.'s of those of one or more days absence.

Evidently physical fitness does affect the child in such a manner that the boy or girl with a high P.F.I. is much more likely to have a perfect school attendance record.

Comparison of School Marks with Physical Fitness.—The ability of a pupil to do the required school work ought to depend upon the strength of the pupil—hence, the necessity of physical well-being if the school work is to be done efficiently. The purpose of this particular inquiry was to determine if the P.F.I. had any relation to the grades of pupils. Correlating the P.F.I. with school success as measured by grades, the following comparisons were obtained: (*a*) —.21 for the boys and (*b*) +.10 for the girls. Thus no relationship seems to exist between the two measures. This research agrees with other findings that school marks are not yet dependent upon the physical condition of the individual.[4]

Comparison of the Amount of Subcutaneous Tissue and Size of Muscle with the P.F.I.—Inasmuch as the amount of subcutaneous tissue and size of muscle are considered to be measures of nutrition,[5] they will be discussed together. Good nutrition is considered essential to the well-being of the individual and hence, it might affect the P.F.I.

The muscle measured in this particular case was the biceps muscle of the right arm. This muscle is one of a group that is used to determine arm strength in the P.F.I. It was chosen because, according to Franzen, it is most characteristic of the total muscle size of the body.

The correlation between the amount of subcutaneous tissue and the P.F.I. is —.02 for the boys and .02 for the girls. The same situation exists in size in the case of muscle. It will be seen from the correlations that no relationship exists between the two measures. Apparently the nutritional condition of the body *as judged by the size of muscle and*

[4] See also Giauque's comments on page 271.

[5] Raymond Franzen, *Physical Measures of Growth and Nutrition.*

amount of subcutaneous tissue has little influence upon general physical fitness.[6]

Comparison of Tuberculin History with Physical Fitness.—The study of the factors of tuberculosis infection presented many difficulties. The complicated medical procedure necessary to determine infection, together with its expense, limits the school in the work done. Only the Indian children had complete and accurate records from Mantoux Tests given by the Indian Agency, and by X-ray plates given by the Minnesota State Tuberculosis Sanitarium. The small number of Indian children tested makes it impossible to accept the findings as in any sense final; yet the trend shown by the study may be significant. The attack of the disease upon many who are ignorant of their infection, the seriousness of the disease, and its wide distribution are still important problems in the health of the school child. It is known that the disease strikes when the body is in poor physical condition. The questions that would follow are: Is there any indication that the P.F.I. may reveal predisposition to infection? Or do pupils who have no sign of tuberculosis infection have low P.F.I.'s?

Correlations were obtained by the bi-serial r method. After correlating the P.F.I. with those children who had a positive Mantoux Test and a positive sign from the X-ray—the correlations were found to be .54 for the boys and .28 for the girls. These coefficients seem to show a slight relationship between tuberculosis and the P.F.I.[7]

Racial Factor as Judged by a Comparison of the Whites and Indians.—The 207 white and 39 Indian children found in the district were compared upon all sociological factors discussed previously. Racial differences are always interesting. However, the same general environment for children of both races tends to equalize factors influenced more by environment, thus tending to bring out better the racial factors and differences that exist. To determine the amount of difference between the two races in P.F.I. score, a comparison was made of the mean and median P.F.I.'s. Table I shows the result of this comparison.

The significance of the differences between the means was determined, and it was found to be 73 per cent more reliable for the girls than necessary to insure reliability. That is, there are one hundred chances in one hundred that the difference between the true measures is greater than zero and hence, the mean P.F.I. of white girls

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[6] This conclusion suggests the propriety of further investigation of the *relative* validities of A.C.H.A. ratings of nutritional status and the P.F.I. as *a measure of nutritional status* as well as of general physical fitness. (All available evidence at the present time indicates that the P.F.I. is also the best objective measure of nutritional status available to school offices. Ed.)

[7] Recent studies in tuberculosis sanitaria seem to indicate but a slight relation if any between the presence of tuberculosis in children and reduction of strength, *in the early stages of the disease.* Of course, in more advanced stages, strength declines rapidly, as does weight. (Ed.)

would be higher than of Indian girls in every group studied which had the same environment. For the boys, it was found that the difference was 32 per cent greater than necessary to insure reliability.

When medians were analyzed it was found that there existed ninety-eight chances out of one hundred that the P.F.I. of white boys would

TABLE I

MEAN AND MEDIAN P.F.I.'S OF WHITES AND INDIANS

	Boys		Girls	
	White	Indian	White	Indian
Number of Pupils	102	24	105	15
Mean P.F.I.	96.39	85.62	93.3	84.17
Median P.F.I.	97.6	84.28	92.5	77.5

be higher than that of Indian boys; and that, for the girls, the median was 72 per cent more reliable than need be to insure that one hundred cases out of one hundred would show the same.

It thus appears that the white child in this section of Minnesota is in better physical condition. These findings agree with the opinion commonly held by residents of this district. Here, however, a reliable and objective measuring device was used, thus giving opinion the support of objective proof.

In Table II, the Indian child seems to vary very little from his white neighbor, except in muscular power, noted above. What differences exist may be due to the degenerating influences that are prevalent among Indians.

TABLE II

CORRELATIONS BETWEEN VARIOUS FACTORS AND THE P.F.I.'S OF WHITES AND INDIANS

Factors	Boys		Girls	
	White	Indian	White	Indian
School Success	—.21	.22	.10	.03
Attendance	—.02	.13	—.21	.02
I. Q.	.0006	—.09	.02	.32
Sims Questionnaire	.29	—.03	.12	.30
Subcutaneous Tissue	—.02	—.12	.02	—.39
Size of Muscle	.07	.10	—.42	—.53
Siblings	White .16		Indians —.57	

Because of the lack of a sufficient number of cases among the Indians, these findings are in no sense conclusive. At best they merely suggest trends of differences that exist between the races. For the most part, as far as the data show, there is relatively little difference. However, it does seem clear that differences do exist between the two races in regard to their physical fitness.

The relationship of physical fitness to the specific sociological factors studied appears to be the same for both races. It is obvious that

the Indian is not so far removed from the white in physical endowment. Given equal standards of living he may again prove equal in all.

CONCLUSIONS AND RECOMMENDATIONS

Remembering always that the data are insufficient to do more than suggest probabilities, the general conclusions drawn from the above data show:

1. That little relationship exists in physical fitness between members of the same family. Brothers and sisters are not sufficiently alike to show a high correlation of similarity. As a result each individual should be considered apart from brothers or sisters in judging or promoting his physical fitness.

2. That strength and physical fitness are but negligibly associated with the general mental status of the pupil as many other studies have disclosed.

3. That there is surprisingly little relationship between the economic status of the child's family and the child's P.F.I. *The physical educator should be acquainted with the home and the economic conditions of each child, but should not assume, because he finds them to be good, that the child will be well cared for.*

4. That some relationship seems to exist between school attendance and physical fitness. The chances are between ninety and ninety-nine out of one hundred that the P.F.I. of the average child with a perfect attendance record is considerably higher than that of the average child with one or more days' absence. However, no correlation of any significance is found between number of days' absence and the P.F.I. This probably is due to the many factors other than illness that influence school absences.

5. That there is no relationship between school success and the P.F.I. This agrees with previous studies. The conclusion *would seem to be* either that the school cannot expect the child to succeed academically only because he is strong and healthy, or that teachers do not take proper advantage of pupils' physical powers in assigning work or requiring performance.

6. That there is but little relation between the amount of subcutaneous tissue and the P.F.I. The conclusion from this would be that one or the other is a poor measure of nutrition.

7. That the difference in physical fitness between the white and Indian children is definite and favors the former. Also, that the relationships, for both races, between the sociological factors measured and the P.F.I. were nearly the same. Probably the Red Man is not such a problem as we often think. Given the same chances as the white, he will develop equally with him.

8. P.F.I. tests are useful far beyond their intended classification and examination purposes.

A Study of the Effects of Two Diets on Physical Powers

By L. Charles Rosenberg, M.D.
and
Frederick Rand Rogers

I

BETWEEN June and December, 1929, one of the authors sought to determine the effects, on children aged five to fourteen years, of a special diet composed largely of milk, whole grain cereals, fruits, vegetables and nuts, and exclusive of meats, *as contrasted with* a diet which included large amounts of meat, white bread, and eggs. The two contrasting diets are described in another report.[1]

Using great care, two equivalent groups of children were selected for the experiment. None were included who were suffering from any disease or who had any defects likely to impair normal growth. All, however, were 10 per cent or more under average weight for height according to the Emerson tables. In the process of selection exhaustive medical examinations were given to some sixty children; the two equivalent groups were chosen by a statistician who attempted to equate experimental and control groups in age, height, weight, and sex.

The two groups lived in identical environments: all were inmates of the St. Mary's Orphanage in Newark, under the care of Sisters. They were segregated only for meals, at other times attending the same classes and enjoying the same play periods, activities, and facilities.

At the beginning and again at the end of the six months-period all subjects were examined by physicians, psychiatrists, and physical examiners. This report deals only with the physical fitness tests which determine "P.F.I.'s," and which were administered to pupils by one of the authors and Carl G. Chamberlain, using identical testing equipment and techniques for both series of tests.

As will be apparent to any person who gives the matter thought, the effects of varying the diet may be very diverse. Some foods are most effective in building bone tissue, others are chiefly useful in providing energy for immediate use, still others are necessary for normal glandular activity, etc. Moreover, the omission of certain foods, because of the vitamins these foods possess, results in seriously detructive diseases.

It is of great importance, among other factors, that the diet provide the body with energy to carry on active life and psychic or emotional

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[1] L. Charles Rosenberg, M.D., "Malnutrition in Children—An Attempt at Standardization of a Diet," *American Journal of Diseases in Children*, (February, 1931).

stimuli to engage therein. Certainly a diet which increased fatty tissues while discouraging the individual from engaging in physical or mental activity would be worse than worthless except for very exceptional cases.

Finally, all life is activity of some sort; and most of it finds expression ultimately in muscular responses to sensory or mental stimuli. If muscular power is increased coincidentally with the modification of diet, the increase is evidence of one or both of two probable causes: the diet has stimulated the subject to increased muscular activity (for muscular power cannot be increased except through activity) and the diet has provided the subject with materials for primary activity and possibly also for permanently improving the cellular tissues and reserves of energy contained therein.

Now, improvement in muscular tissues may be *directly* measured structurally, chemically, or functionally. The two first-named methods are not feasible for living humans; nor are there adequate techniques to measure growth by tests of microscopic structural or chemical changes. Therefore, functional tests must be resorted to (besides the indirect evidences given by analyses of excreta, blood counts, etc.). Objective measures of muscular strength by performance tests possess special values which ought to weigh heavily in the evidence of the values of various diets: *they are directly indicative of power to engage in "life activities."* The individual who lacks strength to walk or write or talk is sorely handicapped either in earning a living or in enjoying his leisure time, while whoever possesses an abundance of muscular strength has an invaluable supply of reserve energy to achieve his objectives in life, whether physical, mental, or social.

It is of the greatest importance, therefore, that the diet be such as will preserve and increase physical strength. If it fails here, it is to be condemned, for the great majority at least.

II

Physical power may be measured in a great variety of ways—by climbing ropes, running races, walking long distances, performing on gymnasium apparatus, heaving weights, and like activities. Or it may be measured by performing those physical evolutions which are the least common denominators of the more complex movements of earning a livelihood. These least common denominators are ability to grasp and hold, lift, and carry weights with the hands, arms, and legs. The heavier the weight which can be lifted and carried, or the longer any given weight can be held or carried, the greater the power of the individual. Moreover, it is important that the heart and lungs be able to supply additional fuel to the muscle cells performing the work. These general observations should be sufficient to reveal the reasons and importance of measuring the efficiency of various dietaries in terms of scores in the following tests:

lung capacity, strength of grip, and abilities to lift weights with the back, legs and arms.

The tests used in this experiment were the "P.F.I. Tests."

III

On June 3 and 4, 1929, Rogers and Chamberlain tested fifty-five children at the St. Mary's Orphanage,[2] after which scores were calculated and records forwarded to the statistician who then divided subjects into experimental and control groups.

On December 6, 1929, the "physical fitness" testers re-examined all subjects. The testers were unaware of the status of subjects (i.e., to which group each belonged) during these tests also. Thus, no bias on the testers' part could possibly affect the records made by subjects. The resulting scores were computed, after which Rosenberg notified the testers of the identity of the two groups.

Preliminary analyses of results indicated that the experimental group comprised of 25 children, gained 174 pounds over a period of six months, as compared to a gain of 131½ pounds for the control group. It is significant that the average subject weighed (in June) approximately 52½ pounds with a Strength Index of 450 points or about 8.6 points of strength per pound of weight. Assuming that about 50 per cent of the increased weight was muscle tissue, it was found that the gain in weight of each group was matched by an apparently equivalent gain in strength. That the increased strength was due to improved "muscle tone" of the muscle cells of one group over the other was not indicated, however, for the *proportionate* gain in strength of both groups was almost identical. The control group gained 12.7 per cent of its original strength while the experimental group gained 14.5 per cent of its original strength. The superiority of the experimental group was, therefore, only 1.8 per cent.

IV

The superiority in strength increase of the experimental group *as a unit* was not indicated as very great by this analysis, but further analyses revealed marked differences between the sexes. Therefore, the data were further analyzed according to sex. There were now four groups.

1. Boys, experimental group
2. Boys, control group
3. Girls, experimental group
4. Girls, control group

The data are summarized in Table I which reports the Strength

[2] Statisticians who would toss this study aside as insignificant simply because of the relatively small number of subjects involved should pause to weigh three other facts: the subjects were given practically every known test to guarantee equality between experimental and control groups; to conduct such an experiment is extraordinarily difficult; and the cost even of this experiment with a small number of children is several thousands of dollars.

Indices of the various groups, together with "gains or losses," and "differences" between groups.

TABLE I

STRENGTH INDEX GAINS OR LOSSES

No. of Pupils	Groups	June	December	Difference	Average Difference
25	Experimental Total	11398	13055	1657	65.3
24	Control—Total	10652	12013	1361	56.7
	Differences	746	1042	296	9.6
12	Experimental Boys	4459	4766	307	25.6
12	Control—Boys	4527	5072	545	45.4
	Differences	−68	−306	−238	−19.8
13	Experimental Girls	6939	8289	1350	103.9
12	Control—Girls	6125	6941	816	68.
	Differences	814	1348	534	35.9

V

The most significant conclusions from the data reported above are as follows:

1. The normal Strength Index for children of the average age and weight of those used in this experiment is between 375 and 400 points. Yet the Orphanage children averaged 450 points, indicating that their general physical powers were far above those which would be secured from a random sampling of public school children. This was to be expected, since the pupils were carefully selected as free of disease and defect.

2. The control group, though equal to the experimental group in age, height, and weight was, nevertheless, 746 points or 7.5 per cent below the experimental group in strength, though of the same weight, indicating that its physical powers were less well developed and, *therefore should improve more rapidly even under ordinary conditions.*

3. Nevertheless, the experimental group gained 296 points more than the control group. Had the two groups been equal in strength at the beginning of the experiment, doubtless the gain of the experimental group over the control group would have been much greater than it was. Seven per cent difference in physical powers for the same age and weight is very great in terms of relative fitness.[3] Moreover, this gain was made during fall and early winter months when the average child's fitness declines.

4. When the boys' and girls' scores are separated, a real difference is revealed. The experimental group boys gained 238 points *less* than the

[3] It is, in fact, the average improvement effected in summer camps of eight weeks' duration on relatively normal children who have changed from a confining school environment to an active outdoor life.

control group boys, while the experimental group girls gained 534 points *more* than the control group girls.

An error in grouping children somewhat vitiates the significance of this discovery.[4] The girls were nearly two years older than the boys chronologically, and, therefore, nearly four years older physiologically. Since the average age was about eleven years, perhaps the girls were 30–40 per cent more mature physiologically than were the boys.

Assuming that the strength differences between the groups are statistically significant, one of two conclusions may be drawn: (*a*) Children at pubescence (the girls were obviously approaching or passing through this stage) are more active physically, and (or) their nutritive needs are better met on the vegetable-cereal-nut diet, than are those of children at earlier ages; or (*b*) girls' nutritive needs are met more effectively and they are more active on a vegetarian diet than are boys.

To the authors these tentative conclusions are of paramount importance. They incline definitely to the belief that the second alternative is a true statement; that is, that girls thrive on vegetarian diets, while boys need meat—or at least, boys need more meat than do girls.

5. As was indicated above, the 1.8 per cent superior gain in strength of the experimental over the control group is doubtless less than would have occurred had the two groups been equalized in strength in June.

6. A 12 to 15 per cent increase in *strength* (not P.F.I.) over a period of six months is almost exactly the normal growth in physical power for the average child. Orphanage children in this experiment gained about sixty-two points each (average), or nearly 14 per cent, *even though they were above average in June.* This indicates that all were unusually active and well-cared-for.

7. The "experimental group girls" gained an average of 103 points or nearly 50 per cent more than normal growth for increase in their age and weight, while the control group boys gained an average of 45 points or about 10 per cent less than their normal expectancy. Thus it appears that even the meat diet as given was not satisfactory for the boys, while the vegetable diet was, *for boys,* almost positively deleterious. The apparent failure of the meat diet for the boys may be partially explained as due to the extreme freedom allowed all control group subjects to eat "as much meat as they wanted." (Statements to this effect were made repeatedly by Sisters in charge.)

8. The "control group girls" gained, under the meat diet, almost as much strength as normal individuals. It is quite possible that they would have been as adversely affected by eating meat as the boys were by the absence of meat *if the girls had been obliged to eat as much meat as the boys chose to.* It was a common observation of the authors that the

[4] This error indicates the lack of concern for sex differences which some psychologists still tolerate.

girls on the meat diet were less eager for "second helpings of chops" than were the boys.

VI

The analysis of strength scores reveals much of interest, and corroborates many tentative conclusions. (1) Evidently both experimental and control groups possessed unusually good physical condition and activity habits at the outset of the experiment. (2) Evidently there are real differences in the nutritive needs of the two sexes, though this conclusion is somewhat clouded by a varying age factor. (3) Probably the boys on the meat diet were permitted to eat too much meat. (4) Probably the boys on the vegetable diet missed certain food elements necessary to their development. (5) Probably girls can forego meat more safely than can boys. (6) Increases in weight in general were accompanied by increases in strength.

Thus, the experiment opens up highly important problems concerning the different nutritive needs of the sexes. Every line of investigation supports this conclusion. Even the errors of experimental procedures add to the force of the general conclusion. Concerning the relative values of the two diets, when the sex element is ignored, no positive conclusion can yet be drawn. Certainly the "vegetarian group" did not suffer any decline of physical activity and reserve power from the vegetarian diet. And certainly the girls throve on this diet.

The Relation Between Physical Fitness and "Success" in Physical Education Activities

By Bessie L. Park

THE PROBLEM

THE PURPOSE of this brief investigation was to determine what, if any, relation exists between Physical Fitness Indices and success in physical education activities in a normal school department of physical education as evidenced by school marks, and, for men, letter awards. Since numerous investigations have been made in high schools and liberal arts colleges to show the relation between physical capacity and success in specific activities, this study concerns itself with the problem in teacher education institutions offering a major in physical education, and with the relation of physical fitness to success in groups of activities rather than in a specific activity.

The activities used were those required of all majors in physical education at the State Normal School, Cortland, New York: namely, gymnastics, dancing, swimming, plays and games, and athletics. Gymnastics, as here designated, include calisthenics, marching, self-testing stunts, and heavy apparatus. Dancing embraces rhythms, folk and national, creative and natural, social, and tap and clog dancing. The plays and games course is confined to those individual and group activities of medium or low organization which are suitable for the elementary and junior high school levels, while athletics include archery, tennis, basketball, baseball, soccer, lacrosse, football, hockey, volleyball, speedball, and track.

The tests used in this study were the P.F.I. battery of strength tests.

The individuals tested were members of the physical education class who entered Cortland Normal School in September, 1931.

THE PROCEDURE

For this study there were selected at random from the freshman class of approximately sixty-five, twenty-five men and twenty-five women. The sixty-five members of the class had been carefully chosen, the previous spring, from approximately two hundred applicants. Strength tests were not administered to the group before selection and appointment. (This is now being done.)

For each of the freshman, sophomore, and junior years, there were assembled ratings, or marks, in the following activities:

For Men	*For Women*
Gymnastics	Gymnastics
Dancing	Dancing
Swimming	Swimming
Plays and Games	Plays and Games
Archery	Archery
Baseball	Baseball
Basketball	Basketball
Tennis	Tennis
Soccer	Soccer
Football	Hockey
Lacrosse	Volleyball
Track	Speedball

Likewise, the letters earned by the men as the result of voluntary participation in varsity athletics were assembled by years. Included in this phase of the study were baseball, basketball, football, soccer, tennis, and track.

Each of the activities listed was pursued for some part of each of the three years, except plays and games which is a one-year course.

At the conclusion of each season, semester, or year, a practical examination, or set of tests, was given in each activity, and marks were assigned, using the following designations:

Rating	*Approximate Numerical Value*
A—very high	94-100
B—good	87-93
C—average	81-86
D—poor	75-80
E—very poor	below 75

These marks were determined in the case of athletics, sophomore and junior gymnastics, and dancing by subjective judgments of teachers concerning:

a) Individual and group techniques.
b) Written rules of each activity.
c) General attitudes toward the activity.
d) General attitudes toward the instructor.

Such was not the case with freshman gymnastics and dancing, and the three years of swimming, the marks for these activities being determined by subjectively measured *performance*. Letters awarded the men were based entirely on ability to perform as determined by records in races or the judgments of coaches.

The marks for all girls' athletics and swimming were assigned by the same teacher, while in the case of the boys three teachers participated, each making the ratings for the three years in his particular sport or sports. All marks in dancing for both men and women were given by the same instructor, while three or more teachers rated the work in gymnastics.

THE RESULTS

The following tables and correlations report the results obtained from this investigation.

TABLES A AND B

RELATIONS BETWEEN PHYSICAL FITNESS INDICES AND "SUCCESS IN GENERAL ATHLETICS" AS RATED BY INSTRUCTORS. (IN THESE TABLES BOTH THE P.F.I.'s AND THE RATINGS ARE THE AVERAGES FOR THE THREE YEARS—FRESHMAN, SOPHOMORE, AND JUNIOR.)

	A Men			*B* Women	
Men	P.F.I.	Rating	Women	P.F.I.	Rating
1	87	C	1	89	D+
2	101	B+	2	115	C+
3	124	B—	3	124	C
4	94	C	4	86	B—
5	104	B—	5	139	B—
6	115	C+	6	110	B
7	85	B—	7	107	B—
8	113	C	8	98	B—
9	89	C	9	71	C
10	110	C	10	72	C
11	77	C+	11	92	B
12	90	C+	12	103	B+
13	118	C	13	93	C
14	77	C	14	99	B
15	112	B—	15	120	B
16	114	B	16	79	C+
17	92	C+	17	112	B—
18	83	C	18	79	C
19	110	C+	19	98	C
20	115	C	20	85	C
21	82	B	21	128	B
22	84	B	22	119	C
23	103	B	23	120	B+
24	101	C+	24	92	C+
25	106	B	25	115	C+
Correlation = .00718			Correlation = —.00416		

THE CONCLUSIONS

All five correlations are low. Concerning the lack of correlation between P.F.I. and athletic awards it should be noted that this is the usual discovery of investigators. Athletic success for men depends on mere strength more than "physical fitness"—the S.I. is the measure to apply.

Concerning the marks assigned by teachers in *courses*, other comments may be made. A possible explanation may be ventured. Strength and skill are inseparable. Therefore, strength tests are highly valid measures of all-round skill in sports, or general athletic ability. This fact has been established again and again. Then it follows that the al-

TABLES C AND D

RELATION BETWEEN PHYSICAL FITNESS INDICES AND SUCCESS IN ALL PHYSICAL EDUCATION ACTIVITIES. (IN THESE TABLES, BOTH THE P.F.I.'S AND ALL THE PHYSICAL EDUCATION ACTIVITIES LISTED UNDER "PROCEDURES" ARE AVERAGES FOR THE THREE YEARS—FRESHMAN, SOPHOMORE, AND JUNIOR.)

C Men			*D* Women		
Men	P.F.I.	Rating	Women	P.F.I.	Rating
1	87	C	1	89	D
2	101	B	2	115	C+
3	124	C+	3	124	C
4	94	C	4	86	B
5	104	C	5	139	C+
6	115	C+	6	110	B
7	85	C+	7	107	C+
8	113	C+	8	98	B
9	89	C	9	71	C
10	110	C	10	72	C
11	77	C+	11	92	B
12	90	C	12	103	B
13	118	C	13	93	C
14	77	C+	14	99	C+
15	112	C+	15	120	B
16	114	C+	16	79	C+
17	92	C+	17	112	C+
18	83	C	18	79	C
19	110	C+	19	98	C
20	115	C	20	85	C
21	82	C+	21	128	B
22	84	C	22	119	C
23	103	C+	23	120	B
24	101	C	24	92	C+
25	106	C+	25	115	C+
Correlation = .0966			Correlation = —.00161		

most complete absence of correlation between the index of strength and that of skill is probably due to the lack of validity, reliability, and objectivity of the school marks. This, in turn, may result from any one or more of the following:

a) A failure to use exclusively objective tests in determining marks.

b) The subjective ratings of two or more instructors in arriving at a single mark.

c) The use of the "rating-scale" method of determining final marks, as is sometimes the case.

d) The effects on marks of student performances in subject matter, examinations of rules, etc.

e) The attitudes of students towards instructors and vice versa.

f) The small number of cases.

TABLE E

RELATION BETWEEN PHYSICAL FITNESS INDICES AND LETTER AWARDS IN VARSITY ATHLETICS. (THE FIGURES IN THE FOLLOWING TABLE REPRESENT THE YEAR IN WHICH THE LETTER WAS WON.)

	P. F. I.	Baseball	Basketball	Football	Soccer	Tennis	Track	Total Letters Won
1.	87			3				1
2.	101	1–2–3		1–2–3				6
3.	124	2–3	2	2				4
4.	94							0
5.	104	1–2–3	2–3	1–2–3				8
6.	115			1–2–3				3
7.	85		1–2–3		3		2–3	6
8.	113	3		3				2
9.	89							0
10.	110				3		3	2
11.	77				3			1
12.	90				3	1–2–3		4
13.	118						2–3	2
14.	77	1–2–3	1–2–3	1	2–3			9
15.	112				1–2–3		3	4
16.	114				2–3		2–3	4
17.	92			1–2–3				3
18.	83				3		1–2–3	4
19.	110		3		1–2–3	1–2		6
20.	115				1–2–3		1–2–3	6
21.	82				1–2–3		1–2–3	6
22.	84	1–2–3	1–2–3		1–2			8
23.	103	3		3	2–3			4
24.	101	2			2–3			3
25.	106				1–2–3		1–2–3	6

Correlation = .0118 102 Total

TABLE F

THE NUMBER OF LETTERS EARNED THROUGHOUT THE THREE YEARS AT THE VARIOUS LEVELS OF PHYSICAL FITNESS.

P.F.I. (3 years average)	Baseball	Basketball	Football	Soccer	Tennis	Track	Total
—99	6	9	5	11	3	8	42
100—114	9	3	8	16	2	7	45
115—	2	1	4	3	0	5	15
Total	17	13	17	30	5	20	102

The result of this brief inquiry confirms once more the finding of others regarding the extraordinary lack of validity and reliability of instructors' subjective ratings of abilities, whether mental or physical. The implication is clear that an overhauling of teachers' marking systems is imperative, at least at Cortland Normal School.

There is a great need for research in order that objective and valid tests of physical skills at various sex, age, and weight levels may be formulated.[1]

[1] A splendid beginning in this field has been made for elementary and secondary school children by Neilson and others in California. See Neilson and Cozens, *Achievement Scales in Physical Education Activities*. New York: A. S. Barnes & Co., 1935. (Ed.)

An Inquiry into the Correlation Between Physical Fitness and Scholastic Standing

By Charles D. Giauque

OBJECTIVES

THE PRIMARY objectives of this study are the determination of correlations between changes in physical fitness and changes in scholastic marks and between the physical strength and the intelligence of high school boys.

That there should be a certain degree of positive correlation between physical fitness and scholarship can hardly be questioned, for physical fitness is the first requisite for scholarship of any degree. The child who is entirely lacking in physical fitness is dead. Consequently, he can have no scholarship either! If alive but ill in bed, he has a small amount of fitness and only a slight possibility of scholarship. The greater his physical power, then, the greater his *capacity* for study. Of course, scholarship is also limited by intelligence and other factors; but the first prerequisite must always be physical power to sit in classes, attend lectures, keep awake and attentive to books, and perform laboratory exercises.

The case is made only stronger when we recall the psychologist's "laws of learning." "Learning depends on readiness, exercise, and effect," say these specialists in the conservation of scholarship.[1] But when one lacks physical fitness, one is unready for any active living. Exercise of almost any mental function sooner or later involves physical responses, too; and the effects of even purely mental exercises are poor if the body is tired, i.e., lacks physical fitness to carry on, minute after minute, hour after hour, day after day. Viewed from another angle, learning is most permanent—study is most effective and scholarship best achieved—when the student is most interested. But he cannot be interested if he is physically fatigued by the primary functions of eating, digestion, respiration, walking to school, and sitting in chairs. The greater the physical fitness, then, the greater the capacity for learning.

The argument outlined above constitutes one of the most effective justifications for supporting physical education in schools and colleges. But it loses some of its potency if teachers fail to harness to studies the increased physical fitness gained by pupils in physical education. The most effective teachers will seek to discover the physical powers of pupils

[1] E. L. Thorndike, *Educational Psychology, Briefer Course.*

as they do their pupils' mental powers and will then adjust scholastic assignments to these capacities, encouraging the more intelligent pupils to accomplish more than average scholastic success. Similarly, the more physically fit pupils should be so stimulated.

However, it almost seems that teachers tend to be contrary in this respect, for it appears that pupils of low physical fitness are induced to spend more time at study while the athletes are permitted to skim through with mediocre performances. If this is true, academic teachers should be made aware of their technical error so that they may improve their teaching methods, adapting assignments to pupils' real powers rather than to their degrees of docility.

One objective of this study, accordingly, might be to discover whether academic teachers are adjusting study loads to pupils' physical powers.

PROCEDURES

A unique characteristic of this study is the comparison, not of the relation between physical fitness and academic status at any particular time, but between *changes* in each. Therefore, the group to be studied must have remained in the school for a fairly extended period of time so that records of changes may be secured. Innate differences between boys and girls render it improper to combine or to contrast their scholastic or physical ratings. It was also necessary to select a school in which both physical fitness tests and scholastic ratings were available.

1. The Lynbrook, New York, High School was chosen as one having available the necessary data.[2] The sixty senior boys of the school were selected for the study. These included athletes and non-athletes, excellent scholars and average pupils.

2. Scholarship data were taken from school records—all "marks" given at the end of each year for each pupil being averaged, this average constituting the pupil's "scholarship." Marks were based on New York State Regents' examination records or, where these were not available, on school averages.

3. Physical fitness scores were determined by means of the P.F.I. tests which were given to all pupils each spring. The Physical Fitness Index of each boy for four years was, therefore, available.

4. Intelligence quotients were also determined by administering the Otis Advanced Intelligence Examination, Form A.

5. The extra-curricular activities of pupils which might affect either scholarship, physical fitness, or both were procured from the *High School Year Book*, whose editors collected the information from the students themselves.

6. Correlation coefficients were computed between pupils' scholastic marks for each year and corresponding P.F.I.'s to determine the general trend.

---

[2] Data supplied through the kindness of Alexander J. Wall, Jr., Columbia University, who wrote an excellent report of which this study is an adaptation.

7. Two groups of pupils were contrasted in scholarship — those whose P.F.I.'s had increased and those whose P.F.I.'s had decreased— to determine whether there were any specific trends hidden by the general trend.

8. A score for extra-curricular activities was computed, evaluating each activity as one unit; and the correlation between extra-curricular activities and scholarship was determined. This procedure measured roughly the amount of influence that outside activities may have had in reducing scholastic marks or affecting physical fitness.

9. I.Q.'s and P.F.I.'s were correlated.

RESULTS

1. The correlation coefficient between P.F.I. and scholastic marks for the whole group was *plus* .10.

2. The correlation coefficient between P.F.I. and scholastic marks for those pupils whose P.F.I.'s increased was *minus* .15.

3. The correlation coefficient between P.F.I. and scholastic marks for those pupils whose P.F.I.'s decreased was *plus* .16.

4. The coefficient between number of extra-curricular activities and scholastic marks was *plus* .10.

5. The coefficient between P.F.I. and I.Q. was *minus* .25.[8]

ANALYSIS

The results seem contrary to what might generally be expected. That pupils under any circumstances should increase in physical fitness while decreasing in scholarship is only one step worse than the general state of affairs—that there is no relationship between the two functions. The very low correlations, however, might be considered an indication that the teachers generally failed to take advantage of pupils' increased physical powers to stimulate more effective study. The mass trends or averages (as shown in graphs I and II) clearly indicate the facts as revealed by the data.

To combine all sets of measurements on a single scale for graphical purposes the following tabulation was prepared. (See page 272.)

(This scale is only approximate in the relations among the three items. It was made up simply as a means of placing all the sets of measurements on one graph. It should not be used for any calculations or measurements.)

Four possible explanations of the conditions revealed are suggested:

1. There is no *reasonable* relation between scholarship and physical fitness. But the absurdity of this conclusion was indicated in the first statements of this study.

2. The causal or effective relation between physical health and

[8] The predictive indices of all these coefficients indicate less than 2 per cent agreement between the functions compared.

scholarship, though positive, is so small that it does not show any measurable effect one upon the other. But if this were true, scholars as scholars would be justified in neglecting their own health. Then was that profound scholar Schopenhauer wrong in advising that "to neglect health for any other advantage in life is the greatest of follies?"

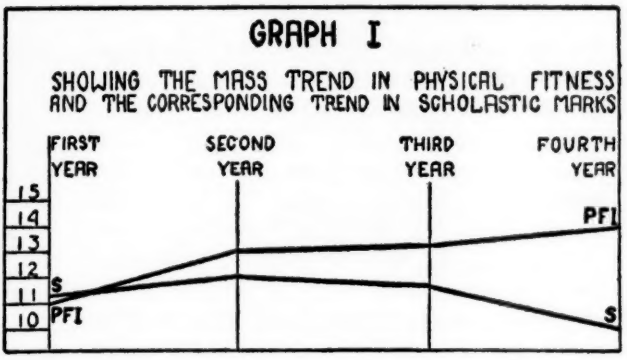
TABLE I

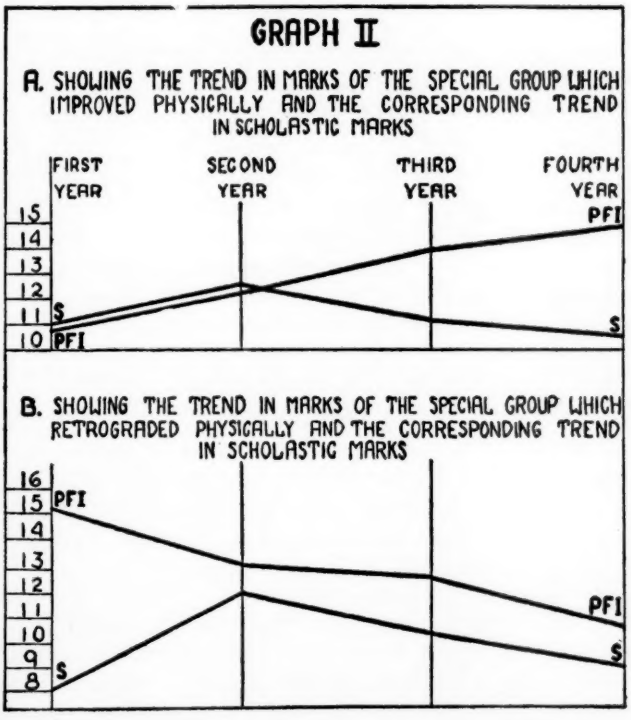
Percentile	Scholastic	P.F.I.	I.Q.
26		153.5	
25		148.0	
24		143.5	
23		138.0	129.36
22		133.5	126.18
21	95.0	128.0	123.00
20	93.2	123.5	119.82
19	91.4	119.0	116.64
18	98.6	114.5	113.46
17	78.8	110.0	110.28
16	86.0	105.5	107.10
15	84.2	101.0	103.92
14	82.4	96.5	100.74
13	80.6	92.0	97.65
12	78.8	87.5	94.38
11	77.0	83.0	91.20
10	75.2	78.5	88.02
9	73.4	74.0	
8	71.6	69.5	
7	69.8	65.0	
6	68.0	60.5	
5	66.2	55.0	
4	64.4	51.5	
3	62.6	47.0	
2	60.8	42.5	
1	59.0	38.0	

3. Teachers failed to lead or drive or otherwise stimulate pupils to use their increasing physical powers to the best advantage. Stated otherwise, the successful efforts of the physical education staff to improve physical fitness were lost on pupils so far as improved scholarship was concerned. These conclusions concerning the failure of Lynbrook teachers to utilize pupils' physical powers seem most reasonable *if measuring procedures were valid.* But:

4. Either the physical fitness tests or the scholarship ratings may be relatively invalid. But the P.F.I. has been found to be one of the most reliable and objective measures in educational use, having a reliability coefficient of .97. Moreover, it possesses perhaps the most scientifically standardized norms of any educational tests and has been validated by scores of experiments.

Then are scholarship ratings invalid? Yes, and notoriously so, when they are the usual teacher ratings. A voluminous bibliography bears testimony to this observation. Even Regents' examinations lack norms





relative to pupil potentialities; therefore, these are not to be trusted in contrast or comparison with P.F.I.'s. We must conclude, then, because teachers' marks and even Regents' examination ratings are highly subjective and lack any usable norms—or any true norms at all—that statements concerning the relation between true scholarship and physical fitness must wait for studies in which scholarship ratings possess proved integrity in norms, reliability, and validity.

It is interesting, too, to discover the lack of correlation between "number of extra-curricular activities" and scholarship and between I.Q. and P.F.I. Evidently studies do not tax pupils' powers, or the scholarship—or health—of those electing the larger number of outside activities would decline.

The negative correlation between I.Q. and P.F.I. is well known. Rogers[4] reports a coefficient of *minus* .10 for 347 high school boys. Reasons for this actual lack of positive relationship are not obscure. As maturity approaches, the more intelligent pupils are led by teachers and parents to concentrate more on mental than on physical activities. Consequently their physical fitness declines, temporarily, and their P.F.I.'s in high school drop. That this condition is temporary and contrary to the usual rule of positive correlations between desirable physical qualities and intelligence is borne out by many studies.[5]

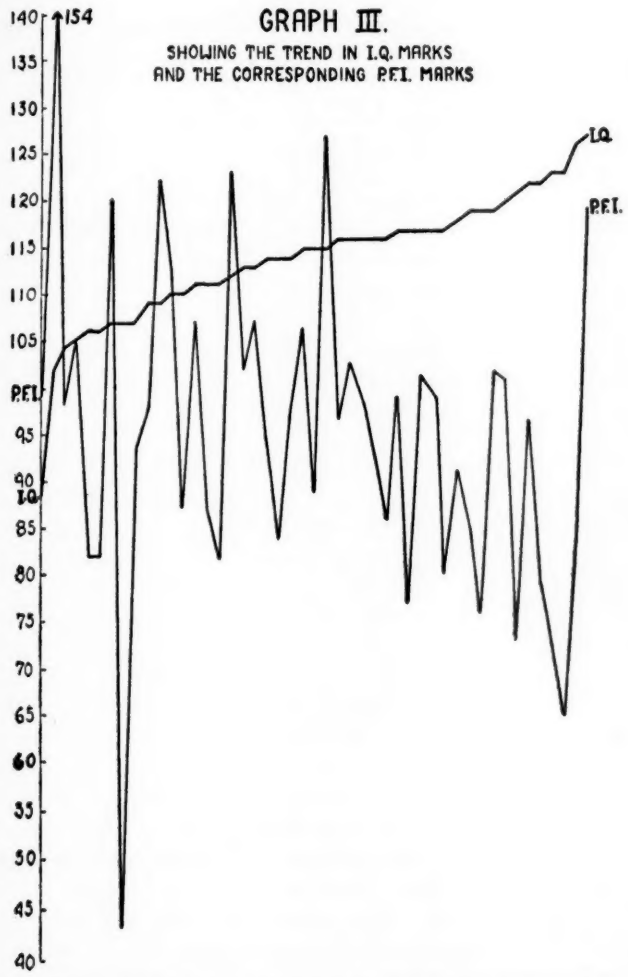
OBSERVATIONS

Further analysis bears out the above conclusions. Scholastic marks generally reach a peak at the end of the second year and then fall off for the third and fourth years to a point below that of the first year. But the lack of scholastic norms renders impossible the conclusion that true learning declines. Perhaps teachers arbitrarily mark more severely in upper grades. Perhaps the subject matter increases in difficulty more rapidly than the increasing maturity of pupils. In either case, if scholarship is defined in terms of scholastic accomplishment—rather than in terms of subjective, unreliable, invalidated, and un-normed teachers' marks—the conclusions of this study might be revised and the teachers vindicated. As it is, they seem to be convicted by a traditional but much-discredited marking system of failure to use the increased power gained in physical education to the scholastic advantage of pupils.

On the other hand, pupils' P.F.I.'s continued to rise steadily until the peak was reached at the end of the senior year. Two points may be made to support the conclusion that this gain is real. First, the P.F.I. tests are properly normed for both age and weight. As pupils (boys or girls) grow older and heavier, their norms increase. Therefore, increased P.F.I.'s indicate growth in fitness *beyond normal expectancy.* Second, P.F.I.'s calculated for freshmen, sophomores, juniors, and seniors in schools where programs are not adapted to individual needs as revealed by objective tests show almost steady declines in fitness for each higher class, the usual drop being about two P.F.I. points per year through both high school and college. *The accomplishments of the academic teachers in the Lynbrook High School,* as measured by school records and because of failure to relate progress to norms, *remain uncertain; but those of the physical educators are certain and positive.*

[4] *Fundamental Administrative Measures in Physical Education,* p. 246.

[5] Frederick Rand Rogers. *Physical Capacity Tests in the Administration of Physical Education.* Chapter VII and accompanying bibliography, 1925.



An interesting sidelight which was revealed in analyzing data is the fact that athletes are not necessarily possessed of greater physical fitness than athletically average pupils. Several subjects with as high as nineteen athletic activities in four years have P.F.I.'s below one hundred, while some with seven to ten non-athletic pursuits have P.F.I. ratings above one hundred. Athletes have high Strength Indices, but not necessarily high Physical Fitness Indices.

One further conclusion might be drawn, if scholarship marks could be trusted to represent true scholastic attainments. It will be observed from Chart I that pupils with average and increasing physical fitness may or may not waste their physical powers; but pupils with declining physical fitness are almost certain to be handicapped scholastically.

The Ankle Lever and Its Classification

By F. H. Pratt, M.D.

AUTHORITIES persist in assuring us that man is supported a-tiptoe by the calf muscles through the aid of a lever of the second class or order—that is, by an effort applied to the heel which under the conditions can amount to only a fraction of the body weight, since the ground must support as fulcrum the remaining lesser fraction. Huxley's classical diagrams (Fig. 1) will serve to recall the conventional designation of levers, as well as the accepted application to the case in point.

A paradox, however, appears when one observes that the above interpretation is contrary to fact—that rising on the toes does not produce levitation, as any platform-scale will show. A satisfactory resolution of this paradox has been available for many years, as may be seen by reference especially to the writings of one of my early teachers, Dr. George Wells Fitz; but, simple as it is, the analysis has persistently escaped recognition, and so needs reiteration. The difficulty arises, of course, from the obvious truth that the raising agent (calf musculature), unlike the gardener lifting a wheelbarrow, is *part of the thing raised*. Can we, then, recognizing this complication, regard it as even a special case of second-class leverage?

A recent and authoritative medical school textbook of physiology pictures a typical second-class lever with its source of power supplied by an *externally suspended* gastrocnemius muscle. As the diagram stands, the author is quite logical in his comment that "power (of body lift) is gained at the expense of speed and extent of movement," for this is the necessary property of such a lever. But unfortunately he also states that this class of lever "is illustrated when the body is raised on the toes." It will eventually be seen that the two statements are quite irreconcilable. I am reminded that even a physicist has included in his examples of the second-class lever the case of the oar in propelling a boat, as if the oarsman (like the muscle) were supported from without instead of *riding in the thing propelled*.

In his entertaining *Engines of the Body*, Sir Arthur Keith pictures a chisel prying open a box. Insert the chisel under the lid, raise the handle of the tool, and the lid now ascends like the body on tiptoe. But Sir Arthur has forgotten to stipulate that to complete the example the operator must sit or stand on the lid *and rise with it*.

Returning to Fig. 1, we see that the raised foot tapping the floor is given as an example of the first order of lever, while the foot lifting the

body from the floor is made to illustrate the second order. Let us compare the equivalents of these two cases in a fancied experiment.

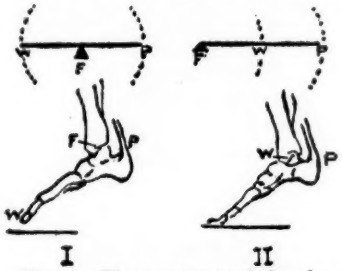


FIG. 1.—First and second class levers, with their customary application to foot extension. (After T. H. Huxley, *Elementary Lessons in Physiology*.)

Imagine yourself in a bed just long enough for a full stretch from top to heel. You try to extend the feet. Resistance is felt, not only against the balls of the feet, but equally against your head. Think now of Huxley's first diagram: conscious only of the toe pressure, you of course think in terms of a first-order lever (which it obviously seems to be). Now shift your attention to the head pressure—positive evidence that the body is trying to "raise" itself horizontally in accordance with the second diagram. You now doubtless think in terms of a second-order lever (which it obviously seems to be). But at this instant the foot-board gives way under the effort, and your toes appear on the far side—a first-class demonstration of pure and simple relativity! Is it sufficient to say that the frail foot-board, failing to play *fulcrum* to an apparent second-order lever, is suddenly transformed into the obvious *resistance* (weight) of a first-order lever? What if both head and toes were to break bounds simultaneously?

Leverage is most conveniently studied as equilibrium rather than as motion. In *a*, Fig. 2, a body weighing 150 lbs. is supported by a lever system plainly of the second order, and so placed that 100 lbs. of the "weight" must by computation be supported by the "power." Does this (as we are generally taught) fit the case of a man standing tiptoe on one leg? No, for we are leaving only 50 lbs. "fulcrum" pressure at the ground or on the platform-scale.

Try the next arrangement, *b*, Fig. 2, where we now attempt to correct the above defect by granting the 150 lbs. full body weight which we know the "fulcrum" must bear if we are to apply the scheme to man. But other figures must now be revised: "power," for example, must be raised to a tension of 300 lbs. So far so good; but note that "weight," instead of remaining the postulated body weight of 150 lbs. must, by the necessary addition of the two supporting tensions, swell to

450 lbs. We have preserved the classification of the lever, but in so doing have again excluded its application to man.

In the third diagram, *c*, Fig. 2, we do the obvious thing—fit the facts by hooking up our "power" arm, not to an outside source of support, but to the system itself. When this operation is performed on *a*, its whole aspect changes; for without increasing the weight of the body we now get the full value of that weight exerted at the ground, while the greatly increased joint pressure is fully accounted for by the muscle tension which adds its value (as down-pull) to the body weight at the joint. Is this a lever of the second class? Apply one by one the numerical criteria of this class, and they all fail: the body pressure at the "fulcrum" is not partial, but complete; the power tension, trebled; while the joint tension, instead of equalling body weight, is likewise three times as great. Turn the system upside-down, as in *d*, merely substituting a 150 lb. weight for the equivalent ground-pressure. Lo, a lever of the *first* order with every condition satisfied—a key to the situation.

If doubts still lurk as to the legitimacy of according full class-one status to the tiptoe mechanism, consider that the muscle does not, as it must in class-two operation, ***shorten*** through a larger arc than the "weight" describes, but through a smaller one: power (of rise) is not "gained at the expense of speed and extent of movement." Therefore in this respect alone we cannot be dealing with a lever of the second

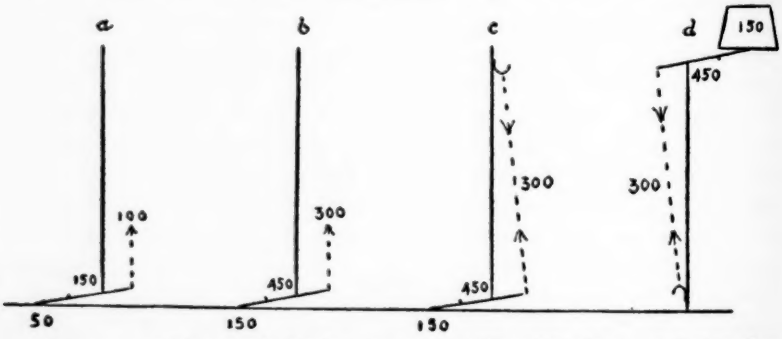


FIG. 2.—*a* and *b*, second class levers carrying different loads. *c* and *d*, first class "ankle" levers, showing relative identity of dynamic conditions. For simplification, all adjustment to center of gravity and diagonal stress is neglected.

order, whereas it is easily computed that the actual extent of muscle shortening fits exactly the specifications of the first order.

The teacher has a wide field of possible examples in emphasizing the principles involved, and in bringing the current misconception to an amusing *reductio ad absurdum* (cf. Fig. 3). To imitate truly the tiptoe mechanism we must sit on a trunk when we open it, stand on the plank

that we would raise at one end from the ground, and become passenger as well as lifter of the wheelbarrow. In performing such feats (all quite possible with connecting gear and proper deference to the center of gravity) respect is gained for the Herculean prowess of the gastrocnemius and its co-workers. On the other hand, to imitate in himself the generally conceived mode of heel-raising, man must either employ

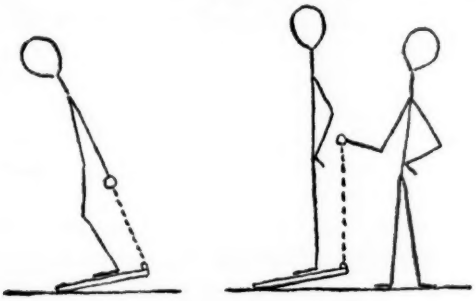


FIG. 3.—First and second class efforts (to be quantified by the pupil).

an assistant to lift upon his bootstraps or else cut away the calf muscles from their bony origin and, preserving nerve connection only, hang them on the wall. Only so can he conform to the requirements of second-class leverage—that is, to heel-raising conditions as commonly assumed and too commonly expounded.

The practical upshot lies then in the recognition, first, of the enormous first-order tensions that the calf muscles have been developed to produce and withstand; and, second, of the even greater joint tensions borne by the arch when the muscles are in action against a multiplied gravity. All such factors tend to be obscured if a superficial view of fundamentals is permitted to influence the teaching of joint-muscle mechanics; for these fundamentals must form the basis of the many modifications and compoundings of forces that enter into the final picture of activity.

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(Most of the current texts which consider the subject may be consulted for the traditional point of view.)

Personalities and Performances

JOHN DEWEY'S characterization of any man as his *ways of behaving* suggests the best clues to the personalities of this symposium's authors. What our authors have done in the way of philosophy or research should reveal what they are. How they have told it is revealing too; though the editor, in the interests of brevity, has perhaps too often obscured what is most characteristic of many of the studies. *Il y a toujours la manière,* as the Frenchman says. There is always the manner of doing things, which is most significant.

But a scientific, or semi-scientific, or even a pseudo-scientific report of necessity obscures much of an author's personality. Moreover, what he says—especially when it has been abstracted from a larger work, or is a mere summary of data and therefore but a part of a larger theme—is likely to be misunderstood or misplaced in the scheme of things. It is the editor's obvious duty and pleasure, therefore, to close this symposium with a rapid review of the various studies and of the personalities of their authors.

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The symposium begins with a statement of the place of measurement in a rational physical education program, with specific illustrations from the rapidly developing program in the "Empire State." It is fitting that **W. W. H. Mustaine,** since 1917 Assistant Inspector of Physical Training, and later Supervisor of Physical Education in the New York State Education Department, should have prepared this résumé. Mr. Mustaine was educated in Kentucky, at Center College, and at the State University in 1899–1900. He has also studied at Chautauqua, Yale, Harvard, and elsewhere. He is a prolific writer on physical education subjects. Only recently he completed, as chairman of a special committee of the A.P.E.A., a report of "Physical Education Objectives and Policies." His whole professional life has been for a generation, and still is, devoted to promoting "the acceptance by educators of a broad interpretation and a sound method of conducting physical education in public schools and colleges."

Kenneth H. Murray's report includes helpful suggestions to physical educators concerning the calibration of instruments, the adaptation of what one has to what one needs, and the possibilities and functions of measurement in the adaptation of secondary school physical activities to individual needs and measurement of results. Mr. Murray has been, since 1930, Director of Physical Education in the Westmount High School, Quebec. His previous professional experience includes two years as Director of Physical Education in the Mt. Royal Branch,

Y.M.C.A., Montreal, and two years as executive secretary of this institution. He graduated from Springfield College in 1927, and has a Higher Diploma from McGill. He has already published several articles on physical education. He was for three years President of the Province of Quebec Physical Education Association. Since 1933 he has been a member of the Legislative Council, Canadian Physical Education Association.

Elizabeth B. Wellman's Master's Thesis, of which the included study is a summary, is a model of sound experimental and statistical analysis. Miss Wellman approached the problem of evaluating various tests of motor ability in an impartial spirit and emerged with surprising results. Her findings ought to be highly instructive to women physical educators in search of valid measuring instruments for high school girls and college women. Miss Wellman is an instructor in the (now) Sargent College of Physical Education of Boston University, of which she is a graduate, as well as of the School of Education of Boston University (1928). Her chief interests are in teacher training, particularly its theoretical aspects. She has travelled particularly to Bermuda and in the West Indies.

V. F. Hernlund has been active in physical education measurement research for the past fifteen years. His articles in this *Supplement* suggesting the relative values of various physical tests for Y.M.C.A. secretaries and uses of the P.F.I. in organizing programs in a junior college are but two of a number which would have been included, but for the pressure of duties incident to establishing himself in his latest post during last December. Mr. Hernlund is now Supervisor of Physical Education Activities, Chicago South Park District. He has been in physical education work in schools, Y.M.C.A.'s, and playgrounds since 1915, in Minneapolis and Chicago, and has instructed in George Williams College, the Graduate School of Nashville, Chicago University, and Vanderbilt University. Mr. Hernlund graduated from George Williams College in 1927 and 1930, and from the University of Chicago in 1930 and 1931. He has published several articles on physiological subjects, and is familiar with every State east of the Mississippi.

Neal G. Barfield, who collaborated with Mr. Hernlund in assaying the Emory Junior College program, graduated from Mississippi State College in 1927, majoring in civil engineering. He took a higher degree from the Y.M.C.A. Graduate School at Nashville. He is now Director of Physical Education at Emory Junior College and Academy, where he has been since 1929. He has spent six summers in community recreation programs. At Emory his intramural schedule includes sixteen sports. His whole interest is in physical education.

Harold L. Berridge, author of the study "An Experiment in the Psychology of Competition" is Director of Health and Physical Education of Edinburg College, Edinburg, Texas. He received two degrees

from the State College of Washington in physical education. He has had a varied experience in the field of physical education; was a physical director of a Y.M.C.A. even before attending college, and has been a student instructor, teaching fellow, and varsity wrestling coach in college, and supervisor of health and physical education in the public schools of Longview, Washington. He is a member of the committee on "Standardization of College Curriculums in Health and Physical Education" in Texas and several other committees for the State Department of Education and State Society. At present he is working on some psychological aspects of motor ability traits.

Harold R. Danford writes interestingly and challengingly of the measurement of foot conditions. He fearlessly—and correctly we believe—rejects some apparent evidence to adduce contrary conclusions. His study ought to stimulate many others along similar lines. Mr. Danford graduated from Ohio University in 1932 and Boston University in 1934. He is Director of Boys' Activities in the Webster Junior High School, in Auburn, Maine. He has taught in Ohio, and in 1934 was Summer Director of Recreation at Warwick Transient Camp in Massachusetts.

C. H. Hubbard has made what appears to be a notable improvement of the silhouettograph. This technique for measuring posture, all too seldom used in the past, has thus been twice improved, Cureton's *conformateur* technique being the other. Mr. Hubbard graduated from Amherst in 1912, and from the Harvard Summer School of Physical Education in 1916. He is now Director of Health and Physical Education at Arnold School, Pittsburgh. He was formerly an assistant director at Western Reserve University in Cleveland, and Western Reserve Academy in Ohio. His major interests, characteristically enough, are orthopedics and foot arches. He is also proprietor of a summer camp in New Hampshire.

John M. Harmon wrote his Ed.D. thesis in the field of health and physical education surveys. The excerpt briefed in this symposium is taken from that dissertation. It is intended for continuous self-survey purposes. Dr. Harmon graduated from Missouri Wesleyan College in 1921, and from Indiana University in 1930 and 1932. He has been a college and university coach and athletic director since 1921 in Central Wesleyan and Evansville Colleges. He now is Director of Physical Activities for Men at Boston University. His major professional interest is athletic administration. During the War he served for several months in France and has travelled extensively in Europe.

Joanna Thayer Dyer has demonstrated once more that the simplest methods are often best. Like strength tests as measures of physical fitness, the Back Board Test of Tennis Ability is surprisingly easy to administer! But it has been validated beyond criticism, it is highly reliable and fascinating to take, and it provides a fitting climax and conclusion to

Part I, for her study is at once highly practicable and statistically and experimentally sound. Miss Dyer graduated from the Boston School of Physical Education in 1926 and Teachers College, Columbia University in 1932 and 1933. She has taught in Woman's College, University of North Carolina, North Texas State Teachers College, and the New York State Teachers College at Buffalo, where she is now head of the Physical Education Practice School. She has been counsellor at summer camps during several summers and travelled in Europe in 1928.

Rochester, under Herman J. Norton, Director of Health Education, was the first large city to experiment seriously with P.F.I. tests, and modify programs to meet needs as revealed by tests. **Carl G. Chamberlain** did much of the work, worrying, and research. His research includes, with that of Dr. Dean F. Smiley's of Cornell, the first validation of the P.F.I. using medical ratings as the criterion. Mr. Chamberlain studied at Rochester and Cornell Universities, and graduated from Ithaca College (1929) and Cornell (1930). He has served on the faculties of the two last-named institutions. He was Director of Health and Physical Education in the Charlotte High School from 1921–28, and since 1930 has had the same responsibilities in the new and very large Benjamin Franklin High School. His articles are well known to physical educators. He particularly enjoys camping, music, and books, and has travelled in Europe.

J. J. Carter has probably had to explain his local program to more people than has any other physical educator in America. Professors of school administration as well as physical education have sat at his feet in the "early days," while neighboring physical directors skeptically stood by. Mr. Carter was a graduate of Battle Creek College in 1915. He has been at Lynbrook since 1921, having begun teaching in New York State in 1916, the first year of compulsory "physical training." During the War he served eighteen months in the Aviation Section of the Army. He has been, since 1929, a member of the New York State Physical Education Syllabus Committee. He is President of the Long Island Health and Physical Education Association and Chairman of an embryo Section on Administrative Measurements of the A.P.E.A. He speaks occasionally to associated boards of education and similar organizations. His major interests are the reconstruction of physical education, measurements, and his Camp Hickory for boys and girls. His title is Director of Health and Physical Education of the Lynbrook, New York, Public Schools.

Harold W. Herkimer and **B. North Parsons** cooperate so closely in the supervision of health and physical education programs in Niagara Falls that they had to remain inseparable in reporting how "D" groups may best be handled. Mr. Herkimer has been Supervisor of Health and Physical Education at Niagara Falls since 1930. He was supervisor of physical education in that city from 1922 to 1930. He

has taught elsewhere. He took diplomas from Springfield College, in 1916 and 1928. He is now President of the Western New York District Health and Physical Education Association.

Mr. Parsons prepared at Cornell University and Ithaca College. He had been a teacher in three schools before going to Niagara Falls in 1925, where he is the physical director in the Senior High School. He travels extensively in the United States and Canada. His chief interests are health, physical education, and sports of all kinds.

Physical educators in the Albany or Capitol area of New York were startled, in 1928, to hear a young woman talk confidently and at great length of the individual needs of scores of different girls. How she knew was revealed in "a chart." Promotions soon took **Helen M. Chesky** away from the Oneida School, where she had for but two years been Physical Director for Girls, but her interest in individual work never lagged. Miss Chesky is now the Physical Director of the Nott Terrace High School in Schenectady, New York. She graduated from Arnold College in 1926 and has taught also in Oswego, New York, and the Kentucky College for Women. She travelled in Europe in 1930. Her chief interests are orthopedic work for school children and the Schenectady Civic Play House. Her report on methods of meeting individual health needs for junior and senior high school girls is a characteristic document.

Leonard Clark has demonstrated what may be done in a single semester with boys who respond actively to tests and corrective procedures. The average physical fitness of Melrose's high school boys is, perhaps, as high as that of any similar group in the nation. Much of this fitness must be laid at Mr. Clark's door. He has been, since 1933, Boys' Physical Director at Melrose High School. Formerly he was a physical director in schools at Montreal and Newburyport and in the Melrose Y.M.C.A.

William H. Whiting has provided public school directors of physical education with an excellent form for reporting progress in activities to administrative officers. Mr. Whiting's outline may be followed easily by directors, no matter what tests they use. Incidentally, the results he reports, for an initial experiment in meeting individual needs, are challenging! Mr. Whiting was a graduate of Springfield College in 1917. He has been in Quincy since 1910, and for the past ten years has been Supervisor of Physical Education for all public schools of that city.

Donald A. MacKenzie has provided this symposium with a thorough analysis of the effects of various collegiate physical activities on participants. This report should be greatly suggestive to college administrators in physical and health education. It shows that various activities have different effects on students, as might be supposed—but he rightly suggests that the methods used by coaches, instructors, and

supervisors may be more effective in improving fitness than the type of activity followed. Mr. MacKenzie was a graduate of Northeastern University in 1931 and 1932. He is now Assistant Director of Student Activities and an Instructor in Physical Education at that institution. Previously he was Instructor in Chemical Engineering. His previous writings were on the rise of tellurium in the vulcanization of rubber and a study of the relationship between participation in extra-curricular activities by college freshmen and their scores in intelligence tests. His special interests are physical education and industrial chemistry.

Arthur L. Jones wanted to answer parents and principals who asked "should boys work or go to camp during summer vacation?" So he sought the answer in a study of physical fitness of various types of summer activity. Mr. Jones graduated in health education at the East Stroudsburg Teachers College, and is studying physical education at Boston University. His study is a summary of his master's thesis which will be presented to the faculty of the University of Maine this spring. He is Director of Physical Education at Framingham, Massachusetts, and has been a physical instructor at Catasauqua and Gettysburg, Pennsylvania; Providence, Rhode Island; Boston; and the University of Maine. He served twenty months overseas with the Canadian Expeditionary Forces, and has been a member of Massachusetts State Committees preparing new courses of study in physical education.

J. Wayne Wrightstone has generously contributed a significant document to the literature of camping; for it reveals not only that positive health values do accrue in well-managed camps, but also the direction which changes in methods must take to be true improvements in camp management. Dr. Wrightstone, who is Research Associate at Teachers College, Columbia University, is a graduate of the University of Pennsylvania (1925), New York University, and Columbia University, from which institution he received his doctorate. His special interests include tests and measurements and other means of securing progress in education and camping. Dr. Wrightstone has written several monographs on educational subjects. His experience includes also that of teacher and principal of the Summit Public Schools in New Jersey.

James A. Wylie has become an outstanding expert in physical fitness testing, program making, and boy scout camp management. His study of the effects of camping on physical fitness provides highly significant data for camp managers everywhere. Mr. Wylie is a graduate of the Savage School for Physical Education in New York City, in 1930; and Boston University. Since 1931 he has been Supervisor of Gymnastics for Men at Boston University. Previously he was an Associate at the Westfield, New Jersey, Y.M.C.A., a Director of Physical Education in the New York Bankers' Trust Company, and in the Boys' Club, New York. Mr. Wylie's chief interests are teacher training, boy scout work, and camping.

John B. Malcolm's report constitutes one of the greatest promises of a worthy future for supervised physical activity which the editor of this symposium has had the privilege of reviewing, for the measurement techniques it reports are equally applicable to physical education in private and public schools and colleges, Y.M.C.A. health and recreation programs, and to all supervised camping programs, whether private or semi-public—whether Y.M.C.A., Y.W.C.A., boy or girl scout, or others. The duties of testing and individual analysis involved in Mr. Malcolm's program may seem arduous to the casual reader. But the ends fully compensate those who, eagerly or otherwise, devote themselves to the careful analysis of individual needs.

Mr. Malcolm graduated from the George Williams College in 1928. He is at present Director of Recreation and Health at the Hyde Park Y.M.C.A., Boston. He has been a Y.M.C.A. physical director at Buffalo, at Oak Park, Illinois, and the Y.M.C.A. Executive Secretary in Cairo, Egypt. He has done field work for the International Committee of the Y.M.C.A. and has directed Y.M.C.A. boys' camps for seven years. His interests lean strongly to research and travel—he has visited, at one time or another, most eastern States, the eastern provinces of Canada, and practically every nation of Europe and the Near East.

Intramural sports, their organization and management, have been **H. Harrison Clarke's** major interest for ten years. While at the Chautauqua High School, in 1925–31, he promoted an excellent program, which was but a stepping stone to Syracuse University, where he has been since 1931 as Instructor in Physical Education, and Director of Intramural Athletics. Mr. Clarke stimulated and guided Mr. Bonesteel in the latter's study of methods and consequences of equalizing athletic teams by the S.I. His educational degrees are from Springfield College and Syracuse University. He has published extensively on various topics. He is an authority on touch football, also on intramural athletic administration, and is particularly interested in measurements. He is also President of a newly-formed Intramural Section of the College Physical Education Association.

Harold A. Bonesteel introduced P.F.I. tests into his high school in 1933-34, with immediate results: parents flocked to the school to learn what it was all about. Soon a nearby community found it needed his services, but Manlius citizens were insistent that he remain with them. Mr. Bonesteel's study of equalizing teams is a stirring challenge to small-school directors of intramural reports. He attended Cornell in 1923–25, graduated from St. Lawrence in 1929, and has since taken graduate work at Columbia and Syracuse Universities. He is Director of Health and Physical Education for Boys at Manlius High School, where he also teaches science. His hobby is training and riding horses. He has travelled considerably in the United States and Canada.

Harry G. Oestreich has experimented with physical fitness tests in

both Minnesota and Massachusetts. His Master's thesis, from which the report included in this Supplement is an extract, recorded several experiments related to the improvement of Y.M.C.A. physical education programs. Mr. Oestreich graduated from Gustavus Adolphus College in 1928 and Boston University in 1934. He is now Supervisor of Intramural Sports at Boston University, and was for five years Director of Athletics and Physical Education at Alexandria, Minnesota. His special interests include the relation of "the philosophy of physical education to the philosophy of human society," and the application of physical fitness tests to industry. In 1932 he travelled in Europe.

Walter A. Cox, Kenneth B. DuBois, and nineteen members of the physical education staff of the Albany, New York, Public Schools prepared five studies concerning the equalization of the powers of opposing individuals or teams. Their reports bear eloquent testimony to the thoroughness with which Albany has attacked the problem of providing the fairest possible conditions for boys and girls to enjoy athletic activities, and the most productive conditions for the development of their social traits. They also demonstrate the propriety of equalizing opposing players in individual as well as team sports.

True to their philosophy of equalization and socialization, the Albany staff demurred when we asked for brief biographies for this symposium: "Have opportunities always been equalized?" they asked —to study, travel, write articles! Nevertheless, it would be unfair to readers to hide the Albany lights under a bushel. Readers will need to know that Mr. Cox has been Director of the Bureau of Health Education at Albany since 1931. Previously he had been active in physical education in Wisconsin, Indiana, Pennsylvania, and New York City. He is a graduate of the Normal College of the American Gymnastic Union, of the University of Wisconsin, and of Columbia University.

Mr. DuBois is Assistant Director of Physical Education at Albany. He graduated from the New York State College for Teachers in 1933, and has been a physical educator in New York State high schools. To the nineteen associates of these gentlemen we are equally grateful for the various Albany reports.

Robert E. Laveaga's report in this symposium of preliminary testing of Northeastern, Harvard, and Boston Optical College students promises to be the forerunner of an important series of research and administrative studies by himself and his associates. Mr. Laveaga graduated in 1922 from the Y.M.C.A. College of Chicago (now the George Williams College). Since 1930 he has been Director of the Recreation and Health Department, Boston Y.M.C.A. Previously he was physical director in Y.M.C.A.'s in Reno, Nevada; Sacramento and San Bernardino, California; and in Chicago; and served during the War in the Army. He is a recognized authority on volleyball and has written texts for this sport and concerning recreation institutes. His

major interest is to "maintain the physical education and recreation programs of the Y.M.C.A. in keeping with modern educational objectives." He has travelled throughout the United States and is interested in oil painting.

Elizabeth Zimmerli began collecting case reports of "unusual P.F.I.'s" in the summer of 1934. These brief studies barely suggest what strength tests may reveal when physicians as well as physical educators, recreational leaders, and camp directors become better interpreters of physical fitness test results. Miss Zimmerli is a graduate of the Sargent School (now College) of Physical Education (1927), of Boston University's School of Education and of New York University. In 1934 she became Director of Physical Education for Girls at the University of Minnesota High School and Instructor in Physical Education in that University. She has taught physical education at the Bridgewater and Worcester, Massachusetts, State Teachers Colleges and physical activities at the South Orange Junior High School. Miss Zimmerli, with her sister, once toured Germany on bicycles and has also travelled in the United States and Canada.

Harold K. Jack has gone afield in investigating the relations between various sociological factors and physical fitness. His studies are interesting and highly instructive because they indicate what may be done with larger numbers of cases and other sociological data. Mr. Jack is Director of Physical Education in the Marshall, Minnesota, Public Schools. Formerly he was a teacher of physical activities and coach in Walker and Deer River, Minnesota. He graduated in chemistry and biology at Hamline University and in physical education from New York University. He has written elsewhere on corrective physical education and is particularly interested in measurement and sociology.

When **L. Charles Rosenberg, M.D.** projected an experiment with a non-meat diet for underweight children, he was not content to measure improvement in terms of gain in weight alone. His search for a supplementary test led him to incorporate strength tests in his study. The surprising revelation of the possibility of sex differences in dietary needs was one result. Dr. Rosenberg was graduated from George Washington University in 1916. He is Head of the Department of Pediatrics, Newark Beth Israel Hospital, and a Fellow of the American College of Physicians, the American Academy of Pediatrics, and the New York Academy of Medicine. His publications are numerous, including studies of inguinal hernias in young infants, early diagnosis and treatment of poliomyelitis, ketogenic diet in pediatrics, etc.

Bessie L. Park has added, in this symposium, to the literature which demonstrates the need of more valid measures of skill; and has raised in a challenging way the problem of differentiating girls' activities from those for boys, whom girls have too long copied to their own detriment. Miss Park has been, since 1915, Director of Physical

Education for Women at the Cortland Normal School, New York. Previously she had been Acting Head of the Women's Department at the University of Nebraska, and an instructor in the University of Texas, the State Teachers College, Emporia, Kansas, and in Chautauqua and Cortland public schools. She is a graduate of Arnold College, and has done graduate work at Harvard and Boston Universities. Miss Park has written extensively in her field and has acted as chairman of numerous committees revising State Syllabi in Physical Education and other important projects.

Charles D. Giauque's public and private interests have been health education and physical education these many years. His analysis of Alexander J. Wall, Junior's material on the relation of physical fitness to scholarship simply carries forward into a new field a very old love. Professor Giauque graduated from Oberlin College in 1916 and from The Ohio State University in 1928. His experience has been chiefly in four widely separated areas: in New York one year, in China seven years, in Ohio seven years, and in Massachusetts three years. While in China he was at various times Director of Physical Education in Shanghai Public Schools, Professor of Physical Education in the Government Teachers College, and Principal of the American Academy at Tsingtao. At Ohio University he was Associate Professor of Physical Education. Professor Giauque is now Professor of Health and Physical Education at Boston University and Editor of the *Physical Education, Health, and Recreation Digest.*

Frederick H. Pratt's delightful analysis of leverage demonstrates beyond peradventure a common error of anatomists and kinesiologists. To read this demonstration is to enjoy an exquisite lesson in pure measurement. The Boston University School of Education and the authors are under a pleasant burden of gratitude to Dr. Pratt for his closing theme. Dr. Pratt studied at Harvard, receiving his baccalaureate degree in 1896, and his M.D. in 1906. He has been, since 1921, Professor of Physiology at the Boston University School of Medicine; he was formerly Instructor in Physiology and Hygiene in the Boston Normal School of Gymnastics, and the Department of Hygiene at Wellesley College, and Professor of Physiology at the University of Buffalo. He has published extensively on the physiology of muscle. His special interests are cellular activity of muscle and nerve—and natural history. In 1899 he was a student at the University of Göttingen.

"Work is the law. Like iron that lying idle degenerates into a mass of useless rust, like water that in an unruffled pool sickens into a stagnant and corrupt state, so without action the spirit of man turns to a dead thing, loses its force, ceases prompting us to leave some trace of ourselves on this earth."

—from a notebook of Leonardo da Vinci